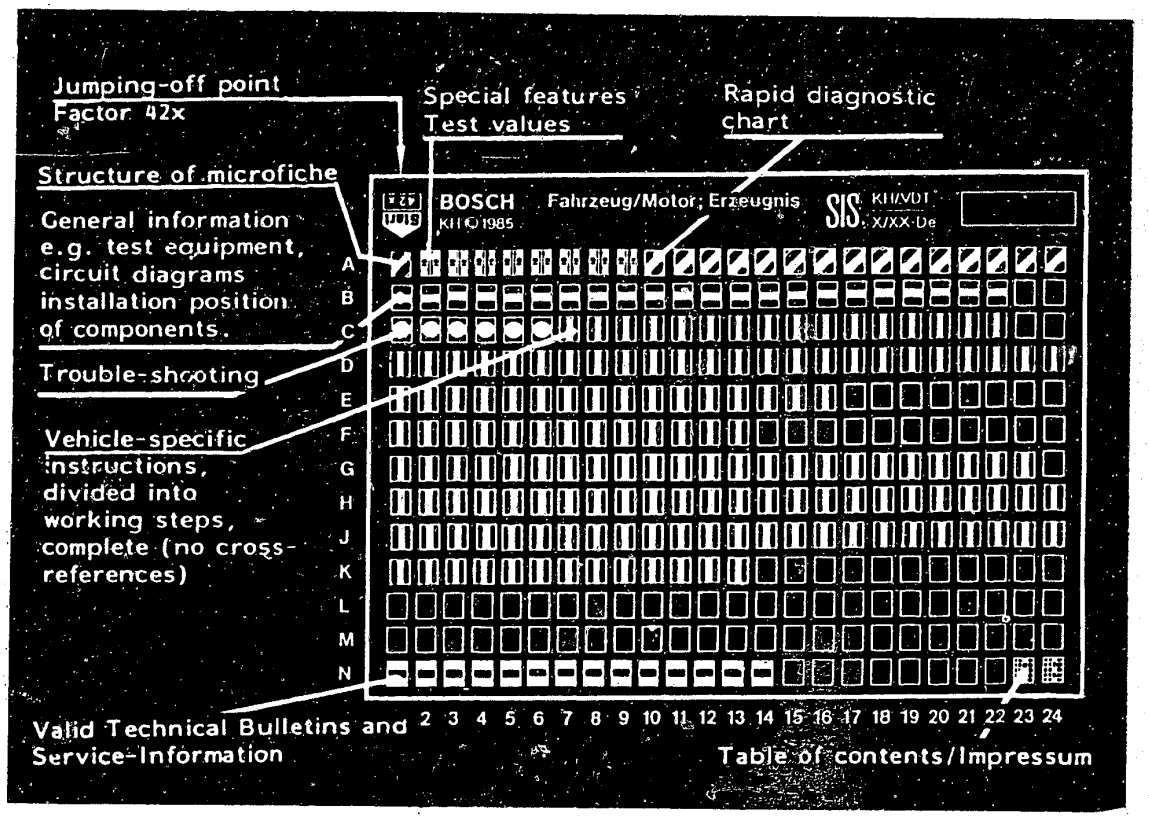
Structure of microfiche



1. Read from left to right

2. Title of microfiche (appears on each coordinate)

E16	Product/component/test step Vehicle/engine

Coordinate

3. Limits of section

Beginning	Mid-section	End	One-page section

4. Purely vehicle-specific passages in the text are marked with a vertical bar.

5. Reference to relevant working steps in the test specifications, e.g. coordinate C6.

C6

A1 Trouble-shooting program

MERCEDES-BENZ 300 E (W 124)

3.0 k/6-cyl. engine, 140 kW (190 HP-DIN)

1. SPECIAL FEATURES

This engine is equippped with KE-Jetronic, system version KE 3. The KE 3 differs from KE 1 (basic system, e.g. Mercedes-Benz 190 E) and KE 2 (with closed-loop idle-speed control, lambda closed-loop control possible, e.g. Mercedes-Benz 190 E 2.3-16) through the following features:

- Digital control unit, map control by microprocessor. Considerably expanded scope of functions of control unit. External influencing of map through encoding plug.

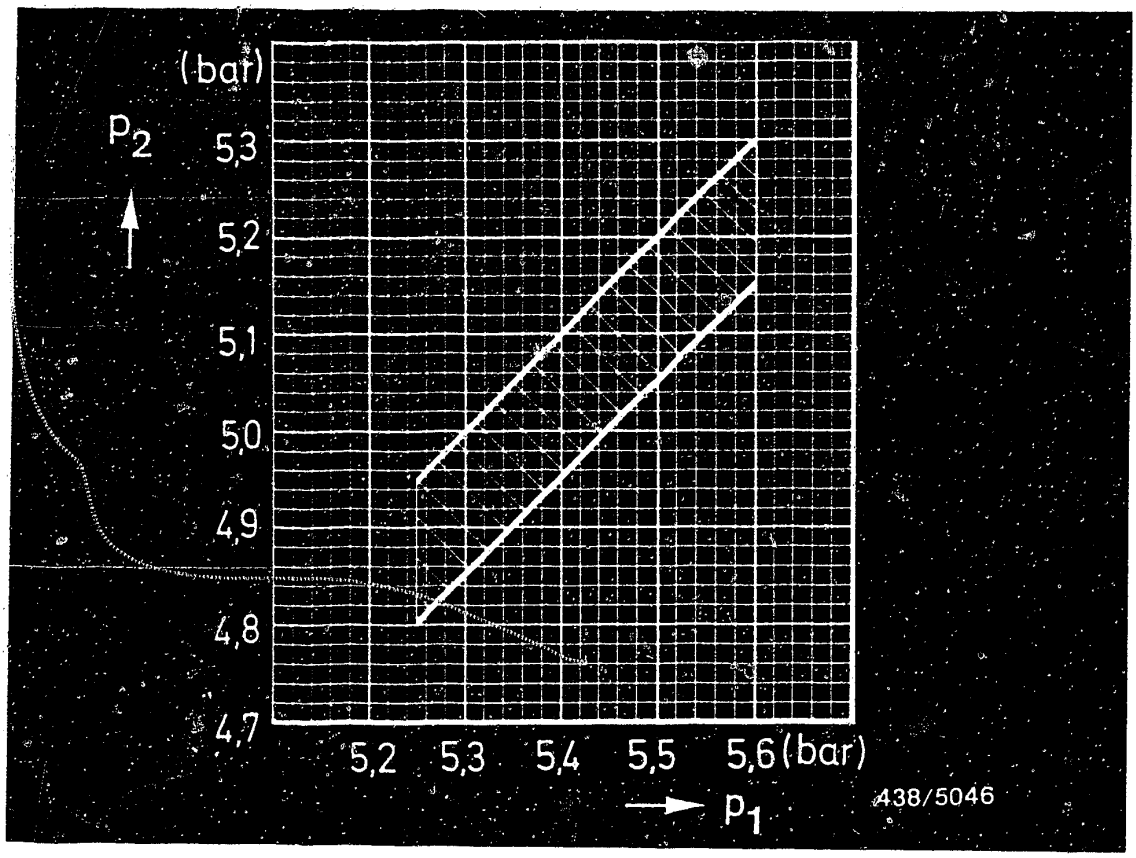
- Electronically controlled closed-loop idle-speed control with single-winding rotary actuator, without bypass adjusting screw.

- The hydraulic/mechanical system of the KE 3 is basically the same as that in the KE 1 and KE 2.

2. Test specifications

Test step	Test specifications*
D1	
2.1 Electric fuel pump:	
Fuel delivery:	min. 1400 cm^3/min.
D9	
2.2 Fuel pressures:	
Primary pressure	5.25 ... 5.6 bar (5.35 ... 5.7 kgf/cm^2)

* Pressures indicated in test specifications in bar (gauge pressure) or in kgf/cm^2 (gauge pressure)

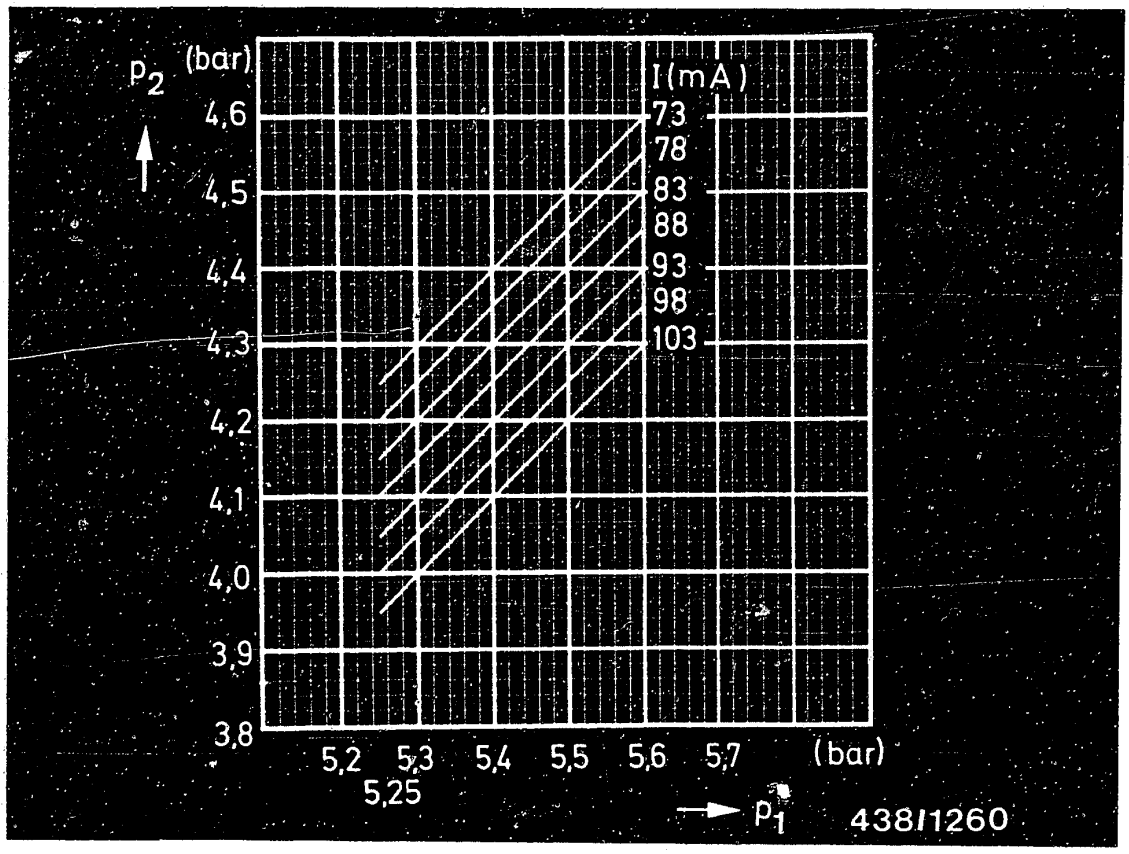


p_1 = Primary pressure
p_2 = Lower-chamber pressure, actuator current = 0 mA

Differential pressure:
(Primary pressure/lower chamber pressure)

D 13

Obtain the lower chamber pressure set value "warm" from the graph corresponding to the primary pressure as measured.



p_1 = Primary pressure

p_2 = Lower chamber pressure "cold". tolerance $\pm$ 0.15 bar

I = Actuator current

Obtain the lower chamber pressure set value "cold" from the graph corresponding to the primary pressure as measured and the actuator current as measured.
(Simulation of "cold" state:
Press button 3 on universal test adapter.)

D21

Test step	Test specifications*

D23

2.3 Test for leaks on the fuel system as a whole:

Minimum pressure	
after 10 min.:	2.7 bar (2.8 kgf/cm²)
after 20 min.:	2.6 bar (2.7 kgf/cm²)

E9

2.4 Injection valve:

Opening pressure	3.0 ... 4.1 bar (3.1 ... 4.2 kgf/cm²)

F1

2.5 Fuel distributor test:
(Testing done with pressure actuator attached, actuator current 0 mA).

Comparative measurement of fuel deliveries at outlets:	Setting point	Max. allowable delivery
Idle:	6.0 cm³/min	6.6 cm³/min
Part load:	40.0 cm³/min	42.5 cm³/min
Full load:	100.0 cm³/min	109.0 cm³/min
Full load with maximum deflection of the air-flow sensor plate. Minimum delivery from all outlets:	140.0 cm³/min	---

*Pressures indicated in test specifications in bar (gauge pressure) or in kgf/cm² (gauge pressure).

Test step	Test specifications*
2.6 Flow through KE throttle in fuel distributor:	130...150 cm^3/min

D 13

2.7 Engine temperature sensor (NTC II)

G8

Resistance measurements:	
Engine cold (+15...+30°C):	1300...3600 Ω
Engine warm (approx +80°C):	250... 390 Ω

2.8 Air temperature sensor (NTC I)

Air temperature +15...+30°C:	1300...3600 Ω

2.9 Idle-mixture-adjusting screw - basic setting

C 17

Fuel-distributor support - needle bearing:	20.9...21.6 mm

2.9 Idle adjustment

The idle speed is automatically regulated by the closed-loop idle-speed control and is dependent on the correct signal from the potentiometer on the air-flow sensor and from the idle switch (microswitch) on the throttle linkage.
It is not possible to adjust the idle air flow.

To measure the potentiometer signal, connect universal test adapter ETT 018.01 with KE 3-Jetronic test lead and voltage measuring instrument.
Sequence of operations and switch positions in accordance with the following test procedure:

- Warm up engine and run at idle speed.

  Idle speed — 650 ... 690 min^{-1}

- CO concentration in exhaust: — 0.5 ... 1.5 vol. %

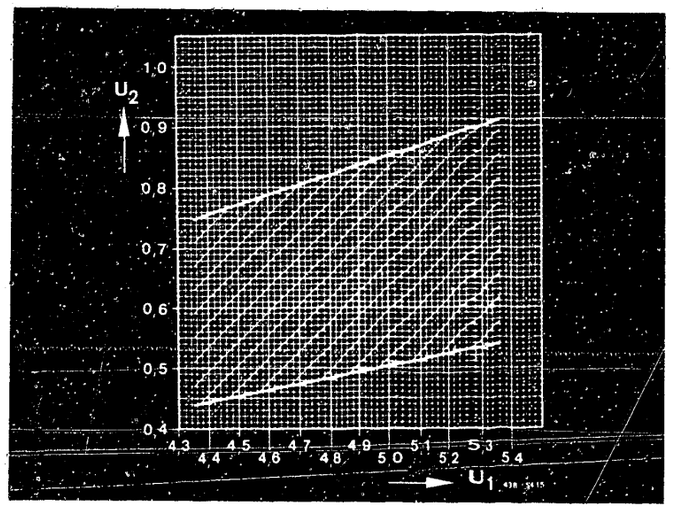
- Check supply voltage for potentiometer. Note down. Tolerance: — 4.35...5.35 V
  (Test adapter: V switch position 10)

- Check potentiometer signal at idle speed (V switch position 11). Establish what reading should be from graph according to supply voltage.

  If necessary, adjust signal at trimming potentiometer (to right of the potentiometer pins).

  Select drive mode. Engine speed: — 500 ... 600 min^{-1}

  Switch on air conditioner (air conditioner switch, fan, temp. controller at minimum temperature). Engine speed: — 600 ... 700 min^{-1}



U_1 = Potentiometer supply voltage
U_2 = Potentiometer voltage signal

3. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER ETT 018.01 with KE-Jetronic test lead 1 684 463 169 and suitable multimeter:

The rapid diagnostic chart below makes it possible for the experienced Jetronic expert to check quickly the electrical/electronic peripheral and control unit functions of the KE-Jetronic including the lambda closed-loop control and idle speed control.

Important instructions for the rapid diagnostic chart below:

The column "test conditions" shows those test steps at which the control unit plug must be plugged in or disconnected. In this regard, make absolutely certain that there is no electricity in the system when plugging in or disconnecting, i.e., it is not permissible to jump the electrical safety circuit.

The "test connections" column provides information on the leads which are connected into the respective measuring circuit, based on the pin assignment in the control-unit plug. Any required trouble-shooting also refers to these leads.

Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
1	↓	4	-	Internal resistance (R_i) of pressure actuator	12 - 10	Disconnect control unit plug	20...30 Ω	G 6
2	↓	5	-	Resistance of NTC II (engine)	21 - 2	Control unit plug disconnected Engine temperature +15°...+30°C: approx +80°C:	 1.3...3.6kΩ 250...390 Ω	 G 8
3	↓	6	-	Resistance of NTC I (intake air) (introduced as of approx mid 1985)	11 - 2	Control unit plug disconnected. Air temperature in region of NTC I: +15°...+30°C:	 1.3...3.6kΩ	 G 10
4	↓	9	-	Throttle-valve switch, idle	13 - 2	Control unit plug disconnected: Throttle valve closed: open:	 0...10 Ω min. 1000 Ω	 G 12
5	↓	10	-	Throttle-valve switch, full load	5 - 2	Control unit plug disconnected: Throttle valve closed: wide open:	 ∞ Ω 0...10 Ω	 G 14
6	↓	11	-	Throttle-valve switch Idle linkage	24 - 2	Control unit plug disconnected Throttle valve closed: Throttle valve open:	 0...10 Ω ∞ Ω	 G 16
7	↓	12	-	Control unit output stage ground	20 - 2	Control unit plug disconnected	0...10 Ω	G 18
8	↓	13	-	Ground, pin 7	7 - 2	Control unit plug disconnected	0...10 Ω	G 20

Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
9	⬇	14	-	Mixture map encoding plug	22 - 2	Control unit plug disconnected Encoding plug position 1: 2: 3: 4: 5: 6: 7:	 0... 10 Ω 460...510 Ω 910...1000Ω 1.54...1.7kΩ 2.48...2.6kΩ 4.2...4.65kΩ 8.2...9.1 kΩ	G 22
10	⬇	15	-	Transmission switch (automatic transmission only)	16 - 2	Control unit plug disconnected. Selector lever position P, N: Drive mode selected:	 0...10 Ω ∞ Ω	H 1
11	5	-	-	TD signal (ignition)	25 - 2	Control unit plug disconnected. Start engine (operate starting motor).	Voltage undefined	H 3
12	6	-	-	Control unit power supply	1 - 2	Control unit plug disconnected. Switch on ignition:	8...15 V	H 5
13	7	-	-	Idle actuator power supply and continuity	3 - 2	Control unit plug disconnected. Switch on ignition:	8...15 V	H 7
14	8	-	-	Cruise control signal (if applicable)	6 - 2	Control unit plug disconnected: Switch on cruise control:	8...15 V	H 9

Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
15	9	-	-	Air conditioner switch-on signal (if applicable)	19 - 2	Control unit plug disconnected. Start engine - run at idle. Switch on air conditioner. Switch on fan. Temp. controller at minimum temperature:	8...15 V	H 11
16	10	-	-	Air-flow sensor potentiometer power supply	18 - 2	Connect control unit. Switch on ignition:	4.35...5.35V	H 13
17	11	-	-	Air-flow sensor potentiometer signal	17 - 2	Control unit connected. Switch on ignition. Sensor plate in rest position: Deflect sensor plate by hand, resulting in continuous voltage rise up to max.	0 V 5.5 V	H 15
18	13	-	1	Temperature signal from control unit for electric fuel pump/cold start control relay	9 - 2	Control unit connected. Switch on ignition. During actuation of button 1:	1.5...1.9V	H 17

Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
19	14	-	-	Consumption signal from control unit term. 4	4 - 2	Control unit connected. Start engine - run at idle: With change of engine speed:	Voltage undefined. Change of voltage	H 19
20	-	-	-	Static current	12 - 12	Control unit connected. Switch on ignition:	9...11 mA	H 21
21	-	-	1	Warm-up enrichment +20°C	12 - 12	Control unit connected. Start engine. Warm up and run at idle speed. Current reading with TA 1 pressed: (No earlier than 2 min after starting):	15...23 mA	H 23
22	-	-	2	Actuator current with engine at normal operating temperature	12 - 12	Control unit connected. Engine at normal operating temperature. Run at idle. Current reading with TA 2 pressed:	-4...+7 mA	J 1
23	-	-	1	Starting enrichment	12 - 12	Control unit connected. To stop engine from starting: o Disconnect electric fuel pump engine-speed relay from plug-in base. o On ignition coil, short term. 4 to ground through min. 2kΩ resistor (e.g. Bosch sleeve-type suppressor (5 kΩ) 0 356 500 001 and spark gap (e.g. Bosch 1 684 531 000). While TA 1 pressed, operate starting motor. Current rises (max. 1s) to:	68...88 mA	J 3

Rapid diagnosis chart for universal test adapter ETT 018.01

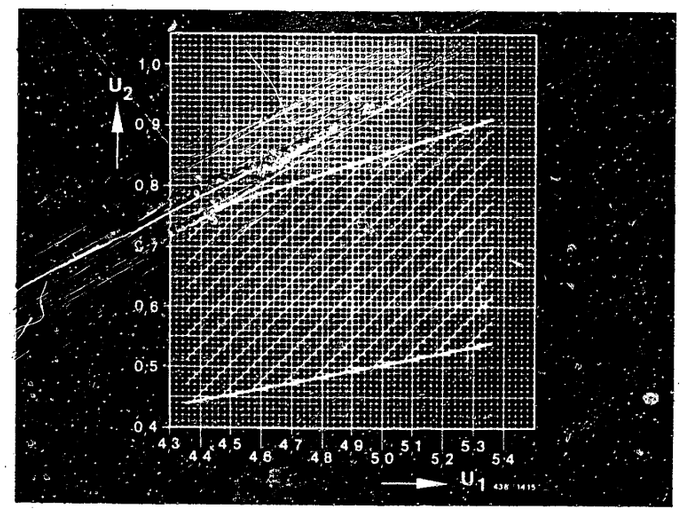
Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
24	-	-	1	Post-start enrichment	12 - 12	Control unit connected. Start engine (at normal operating temperature) while pressing TA 1. Current reading: Current reading remains for approx 45 s, and is then slowly cut back to:	24...32 mA 15...23 mA	J 7
25	-	-	1	Acceleration enrichment	12 - 12	Control unit connected. Run engine (at normal operating temperature) at idle speed. While pressing TA 1, suddenly accelerate engine. Current rises (approx 1 s) to: Note: Current reading is dependent on the intensity of acceleration (distance/time of sensor plate movement).	max. 66 mA	J 9
26	-	-	-	Overrun cutoff	12 - 12	Control unit connected. Swap over positive and negative terminals of ammeter. Start engine (at normal operating temperature) and hold at approx 2000 min^{-1}. Operate idle throttle-valve switch (microswitch on throttle linkage) by hand. Engine hunts. Current reading during the falling engine-speed phase: With cruise control on, there must be no overrun cutoff.	-40...-80mA	J 11

Rapid diagnosis chart for universal test adapter ETT 018.01

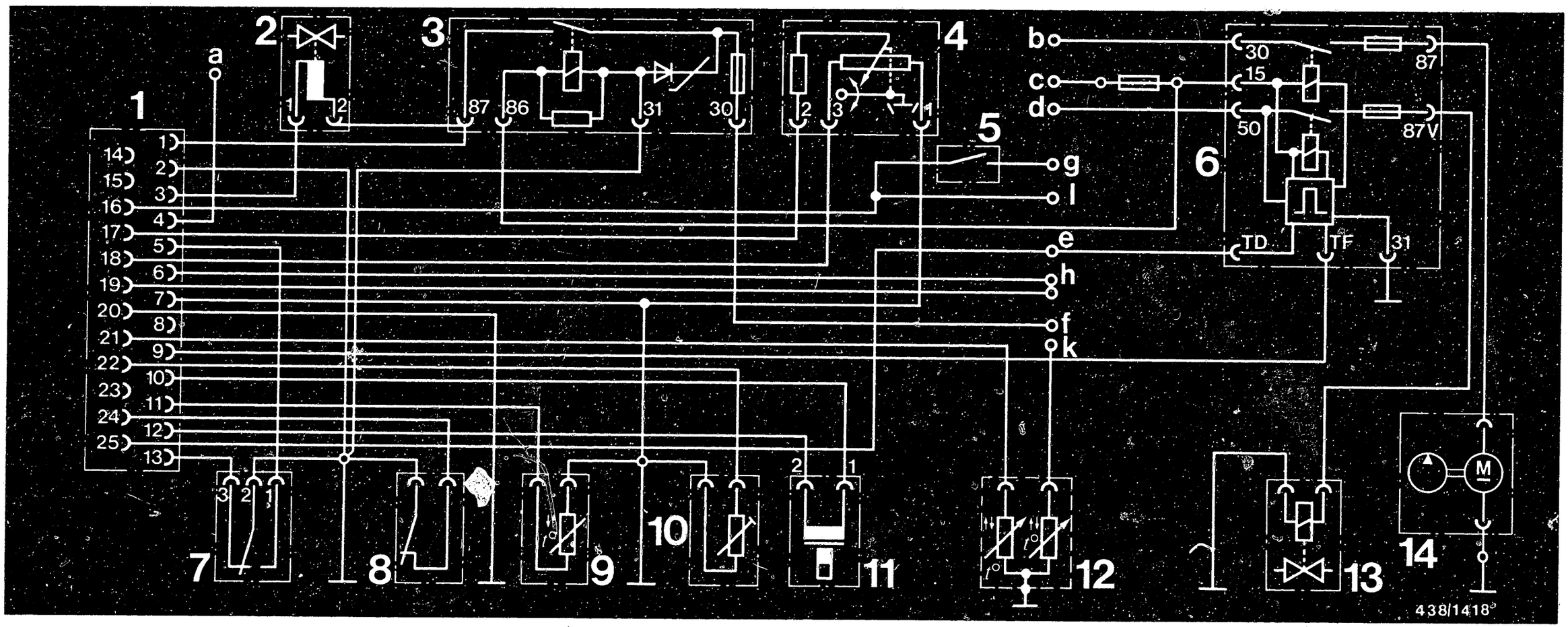
Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
27	-	-	-	Full-load enrichment	12 - 12	Control unit connected. Run engine (at normal operating temperature) at idle speed. Current reading: Briefly fully depress accelerator (full-load throttle-valve switch must switch). During the engine-speed rise, current reading must rise by: Caution: Do this very briefly so that engine speed does not rise too much - and so that engine is not damaged.	(-4...+7 mA 3 ... 8 mA	J 13

Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position V	Switch position Ω	Button	Under test	Test connections	Test conditions	Test specifications (reading)	For trouble-shooting see
28	11	-	-	Closed-loop idle-speed control	17 - 2	Control unit connected. Connect voltmeter to adapter. Connect tachometer (e.g. BOSCH motortester) to engine. Connect CO analyzer. Run engine (at normal operating temperature) at idle speed. Idle speed: CO concentration in exhaust: Measure voltage signal from air-flow sensor potentiometer. Calculate what reading should be from graph according to supply voltage (volt switch position 10). If necessary, correct voltage signal at trimming potentiometer on air-flow sensor. Select drive mode. Engine speed: Switch on air conditioner (air conditioner switch, fan, temperature controller at minimum temperature). Engine speed:	650...690min^{-1} 0.5...1.5 vol. % 500...600min^{-1} 600...700min^{-1}	J 15

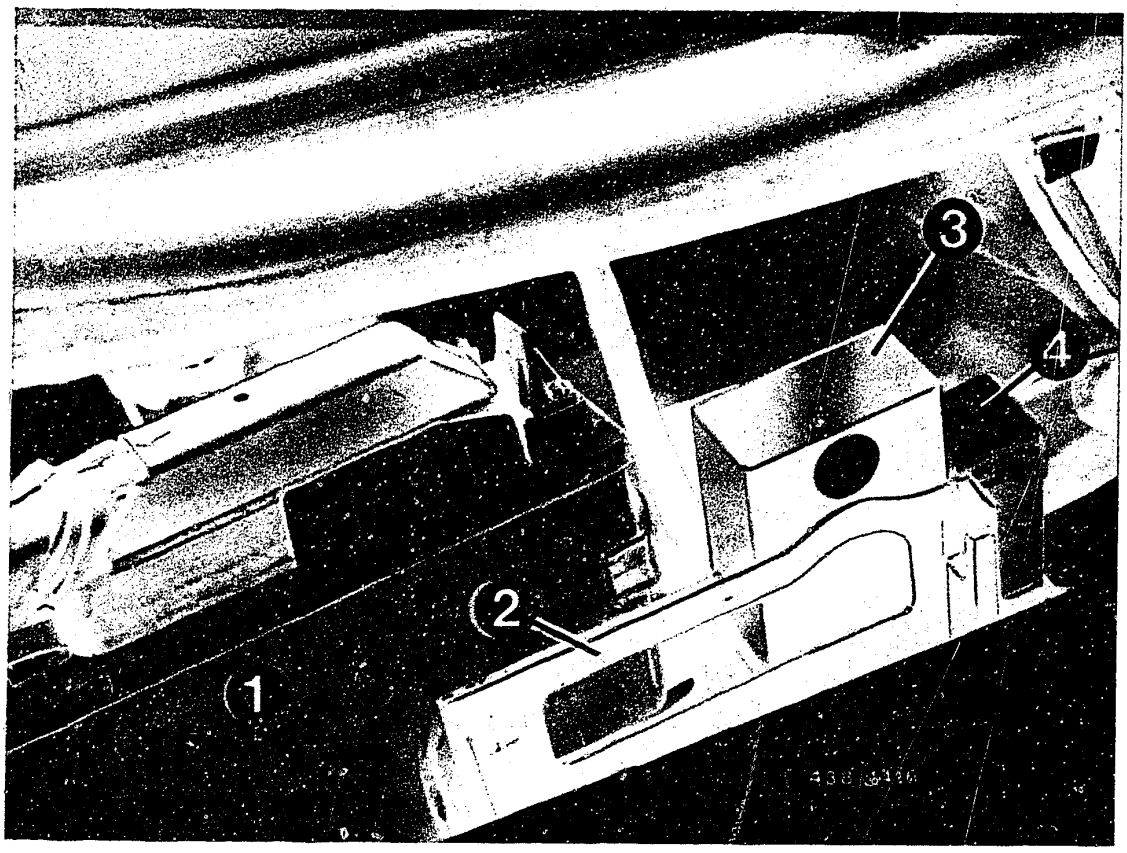


U_1 = Potentiometer supply voltage
U_2 = Potentiometer voltage signal



4. ELECTRICAL TERMINAL DIAGRAM WITH ELECTRIC FUEL PUMP SAFETY CIRCUIT

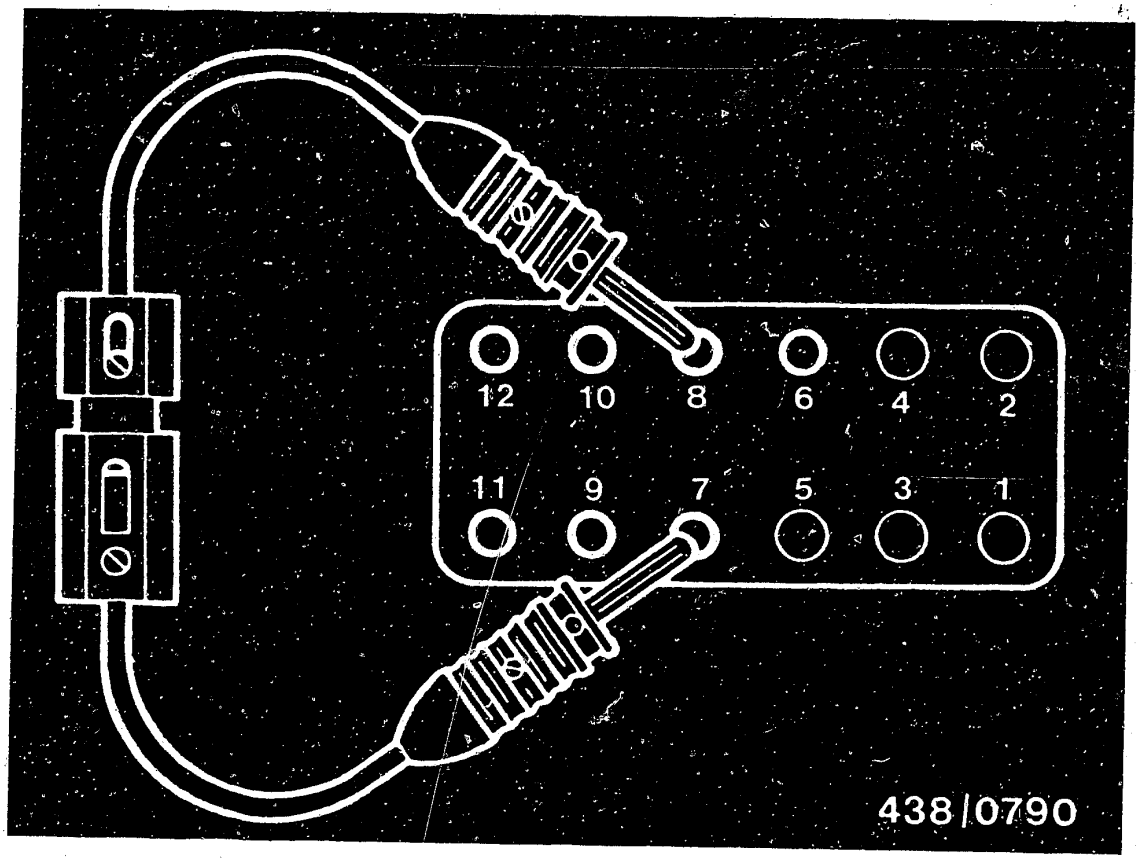
1 = KE-Jetronic control unit
2 = Idle actuator
3 = Overvoltage protection relay
4 = Air-flow sensor potentiometer
5 = Transmission switch (automatic transmission)
6 = Electronic relay for electric fuel pump and start valve energization
7 = Idle/full-load throttle-valve switch
8 = Idle/linkage throttle-valve switch
9 = Intake-air temperature sensor (NTC I)
10 = Map adjustment encoding plug
11 = Electro-hydraulic pressure actuator
12 = Engine temperature sensor (double NTC)
13 = Start valve
14 = Electric fuel pump
a = Output of consumption signal for trip computer
b = Terminal 30 (B+)
c = Terminal 15
d = Terminal 15a starting motor
e = TD signal - ignition
f = Terminal 30 (B+)
g = Terminal 50 - starting motor
h = Connection of cruise control operator panel
i = Connection of air conditioner control unit, term. 87
k = Ignition system (EZ-L)
l = Terminal 50 - Ignition lock



1 = ABS control unit
2 = Control unit holding rail
3 = Engine-speed and cold-start control relay
4 = Overvoltage protection relay

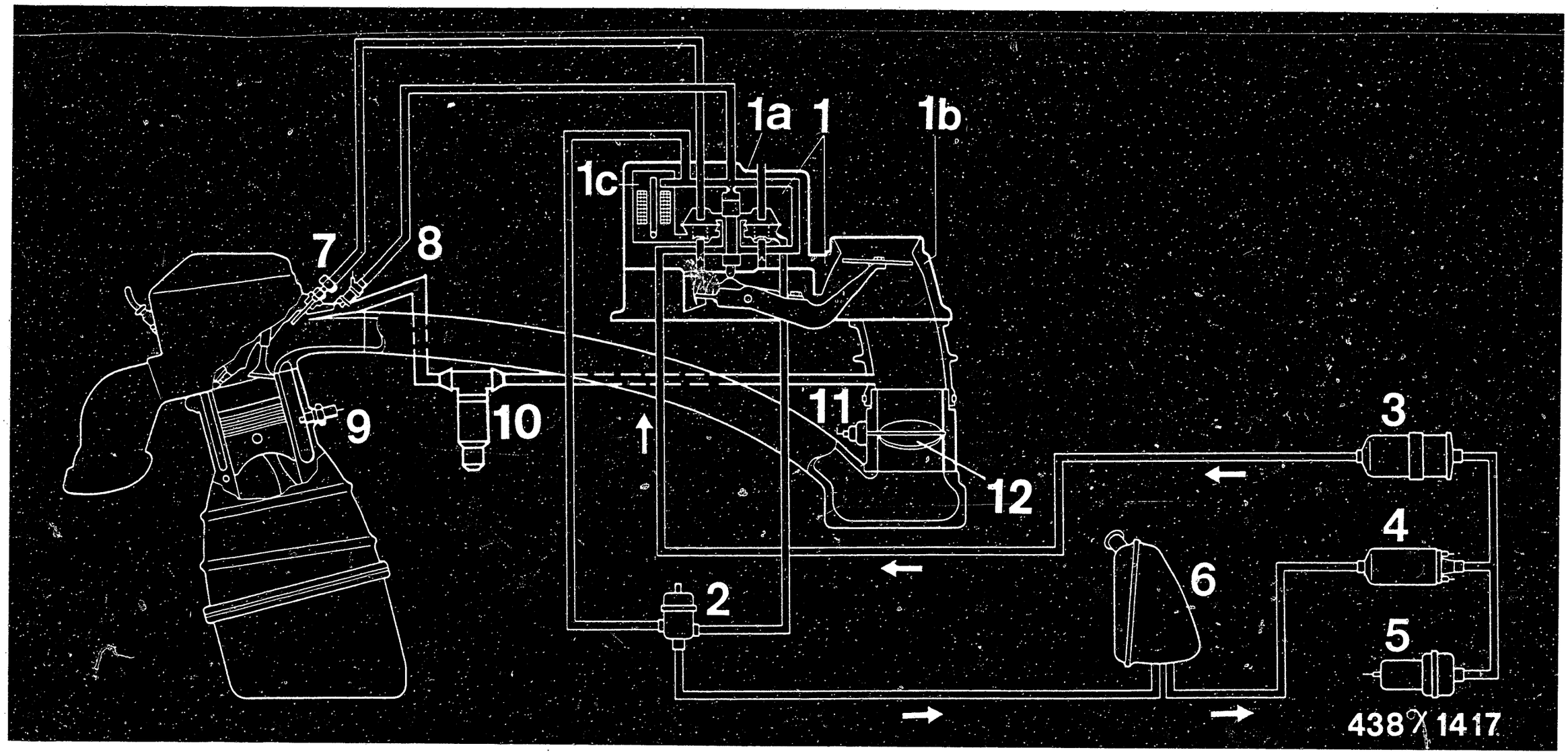
Jumping the electrical safety circuit

The electrical safety circuit for the electric fuel pump must be jumped for all pressure and fuel-delivery tests. To do this, remove the relay - Item 3 (in equipment space, on right-hand side as viewed in forward direction of travel) from relay base.



Jump sockets 7 (87) and 8 (30) in the relay base with connecting lead. Use connecting lead 1.5 mm² with fuse holder and 16 A fuse (to be user-fabricated as per sketch).

Important: In order to test all electrical/electronic functions with the engine stopped, switch on ignition only. The safety circuit must not be jumped when doing this so as to prevent undesired injection of fuel (danger of engine damage).



5. DIAGRAM OF AIR AND FUEL LINES

1 = Mixture-control unit
1a = Fuel distributor
1b = Air-flow sensor
1c = Electro-hydraulic pressure actuator
2 = Primary pressure regulator
3 = Fuel filter
4 = Electric fuel pump
5 = Fuel accumulator
6 = Fuel tank
7 = Injection valve
8 = Start valve
9 = Engine temperature sensor (double NTC)
10 = Idle actuator
11 = Idle/full-load throttle-valve switch (further idle throttle-valve switch on linkage)

6. GENERAL INFORMATION

6.1 Introduction:

This microcard deals with all testing and repair measures on the KE-Jetronic (system version KE 3) in the Mercedes-Benz 300 E (W 124). All components of the KE-Jetronic are included in the individual test steps with the corresponding test specifications.

The KE 3-Jetronic differs fundamentally from the known KE-1 system version (e.g. Mercedes-Benz 190 E) or KE 2 (e.g. Mercedes-Benz 230 E) through the following features:

- Map control by microprocessor; digital control unit.
- In the Mercedes-Benz 300 E external influencing of map by encoding plug.
- Validity check in control unit.
- Considerably expanded scope of functions (function triggering) of the potentiometer on the air-flow sensor.
- Closed-loop idle-speed control. Control electronics integrated in KE control unit (as KE 2). Idle actuator in form of single-winding rotary actuator.

This expanded scope of functions in the electronics of the KE 3 is taken into account in the test charts on this microcard. The mechanical/hydraulic part of the KE 3 is, with the exception of deviating values, the same as that in the KE 1 and KE 2.

For trouble-shooting on the KE-Jetronic, it is assumed that the ignition is in order and that the engine is mechanically perfect.

The structure selected for this microfiche is such that, in addition to these general instructions, lines A and B contain all the information needed by an experienced mechanic for a quick, complete check of the system. This includes the following sections:

- All mechanical, hydraulic, and electrical test specifications.
- A test step chart for the Bosch universal test adapter for testing all electric/electronic functions.
- A listing of the test equipment and special tools needed, and illustration of the installation position for all components.

The test specifications and the chart of test steps contain in each instance the reference to the Coordinates in which each section of the tests is described in detail.

The trouble-shooting chart on Coordinates C1 to C6 will make it easier to determine the test steps that are to be carried out when certain faults are found. Select the possible cause in the trouble-shooting chart appropriate to the complaint from the customer or the problem you yourself have found. The coordinate references at the end of the cause column refer to the corresponding test step, with all the required instructions.

6.2 Important instructions for general work on vehicles with the KE-Jetronic

- Never start the engine without the battery securely connected.
- Never disconnect the battery from the vehicle electrical system while the engine is running.
- When fast-charging the battery, disconnect it from the vehicle electrical system.
- Remove the KE-Jetronic control unit whenever temperatures are above +80°C (paint-drying installations).
- The KE-Jetronic control unit is to be removed during electronic welding jobs (e.g., spot welding).
- Make sure all wiring-harness plugs are seated properly.
- Never connect or disconnect wiring-harness plugs for the control unit while the ignition is turned on.

6.3 Important instructions for work on the KE-Jetronic:

Whenever any fuel connections are taken apart, or parts taken out, including those on the vacuum system, new gaskets are to be used when restoring those connections or parts.

Be extremely neat and clean when working on the KE-Jetronic. Clean fuel connections thoroughly externally before separating them.

During tests with the electric fuel pump running, never deflect (press down) the air-flow sensor plate, because fuel is injected through the injection valves when that is done. This can cause extremely serious damage to the engine in a subsequent start.

6.4 Scope of functions of KE-Jetronic, system version KE 3, in Mercedes-Benz 300 E

Map control

Depending on the instantaneous operating variables of engine temperature, load and engine speed, the corresponding operating range is established from the map stored in the control unit, thus determining the air-fuel mixture. The mixture can be enriched as well as leaned.

The load signal comes from the potentiometer on the air-flow sensor and is relayed as a voltage signal to the control unit.

At idle and full load there are special map characteristics which are geared to these load ranges. For this purpose, throttle-value switches detect the operating conditions "idle" and "full load".

This system imposes high requirements on the accuracy of the potentiometer on the air-flow sensor. Changing/ re-adjusting the potentiometer is not possible using workshop equipment.

Multiplicative map adjustment

By means of an encoding plug it is possible to selectively influence the map in certain operating ranges. For this purpose, there are 7 different plug positions, whereby position 1 corresponds to the original condition.

See table for significance of the individual encoding positions:

Plug position	Improvement of function (x)			
	Post-start enrichment	Warm-up enrichment	Acceleration enrichment	Map
1	-	-	-	-
2	-	-	-	Leaning
3	-	-	-	x
4	-	x	-	-
5	-	x	x	-
6	-	-	x	x
7	-	x	x	x

Warm-up enrichment

Enrichment as a function of engine temperature and, to a small extent, engine speed.

Warm-up enrichment is cut back at approx +60°C.

Starting enrichment

Triggered within a certain engine-speed range, independent of temperature.

Duration of enrichment approx 1 second.

Post-start enrichment

Triggered within a certain engine-speed range, after the end of starting enrichment.
Magnitude and duration of enrichment dependent on temperature. Slow cut-back (e.g. at + 20°C = approx 30 seconds) to warm-running value.

Acceleration enrichment

Triggered in case of positive load change by potentiometer in air-flow sensor.

The magnitude of enrichment is dependent on the engine temperature and on the steepness and magnitude of the potentiometer signal.

Cut-back time approx 1.5 seconds.

Acceleration enrichment is suppressed when starting, with throttle valve closed and at engine temperatures above +80°C.

Overrun cutoff, engine-speed limitation

Overrun cutoff is effective with the throttle valve closed. The engine-speed thresholds are fixed as a function of temperature.

Overrun cutoff is suppressed if the cruise control is on.

The cut-off speed for engine-speed limitation is approx 6500 min^{-1}.
The hydraulic operating principle is identical for overrun cutoff and engine-speed limitation.

Full-load enrichment

Full-load enrichment takes place as a function of load and engine speed and with the throttle-valve switch closed.

Closed-loop idle-speed control

Idle-speed control is performed by regulating the amount of mixture supplied to the cylinders. For this purpose, there is an idle actutator (instead of an auxiliary-air device) in the air bypass line around the throttle valve.

The idle actuator is a single-winding rotary actuator in which the rotary slider, which determines the opening cross section, is mounted directly on the armature shaft.

The rotary movement of the armature caused by electromagnetic force acts only in one direction which is opposed to the force of a built-in spiral spring. When deenergized, the spring forces the rotary slider against a factory-set stop. Depending on the setting, there is thus a certain opening cross section (emergency-operation cross section).

In operation, there is an equilibrium of forces according to the energization current signal at the rotary armature, so that there is a current-dependent, defined opening cross section at the rotary slider.

The actuator is energized by the KE control unit at a constant frequency (100 Hz) and with a variable on/off ratio dependent on the load signal (potentiometer) and the actual engine speed.

7. TEST EQUIPMENT AND TOOLS

- Universal test adapter ETT 018.01 - 0 684 101 801
  For testing the electrical-electronic functions of the system.

- KE 3-Jetronic test lead 1 684 463 169
  Used in conjunction with the test adapter.

- Multimeter
  Used in conjunction with the test adapter (e.g. BOSCH-Motortester MOT 300/400 with shunt 1 684 503 098 or commercially available e.g. Fluke-Multimeter 75)

- Pressure tester KDJE-P 100
  For testing all fuel pressures and for leak test on system.

- Connecting-parts sets KDJE-P 100/10 and .. /11
  For connecting the pressure tester.

- Valve tester KDJE-P 400
  For testing the injection valves.

Test media: Test gasoline.
BOSCH order designation VS 14 942 CH
(previously part number 5 973 340 650).
Bosch test gasoline can be obtained in 5 litre cans from the following supplier:

Oskar Gnamm & Co
D-7531 Kämpfelbach-Bilfingen

- Tester for delivered quantity comparison KDJE - P 200
  For comparison of quantities delivered from the individual outlets of the fuel distributor.

- Set of lines KDJE - P 200/25
  To connect the tester for delivered quantity comparison.

- Adjusting wrench KDEP 1035
  For exhaust gas adjustment.

- Adjusting tool KDJE 7456
  Adjustment and fixing in place of the air-flow sensor plate.

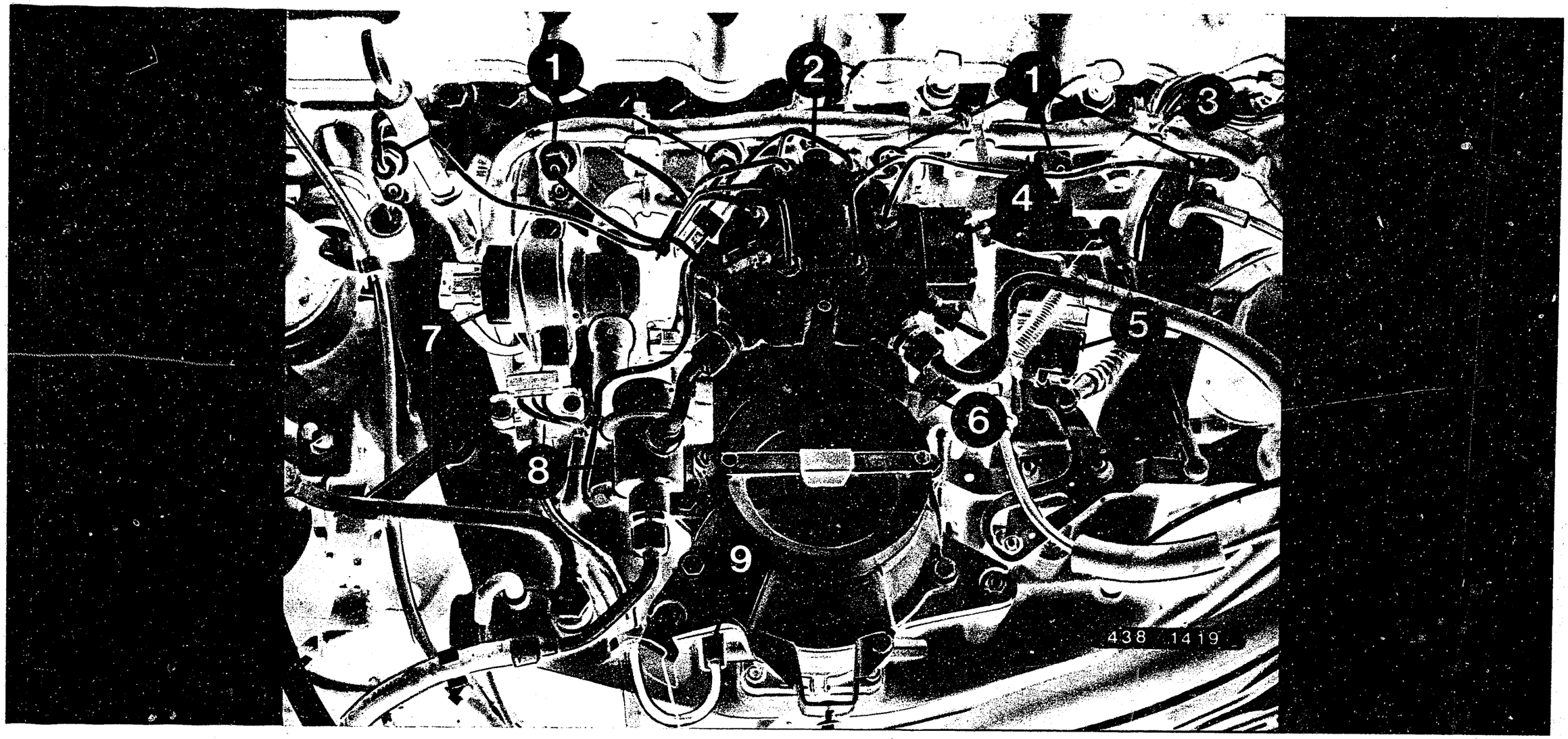
- Graduate, capacity approx. 1.5 ltr.
  Commercially available. For measurement of the deliveries from the electric fuel pump.

- Electric connecting cable KDJE 7450/70
  For direct connections to the components being tested.

- Tachometer (e.g. BOSCH-Motortester MOT 300/400 or commercially available)

- CO analyzer (e.g. BOSCH ETT 008.04, ETT 008.05)

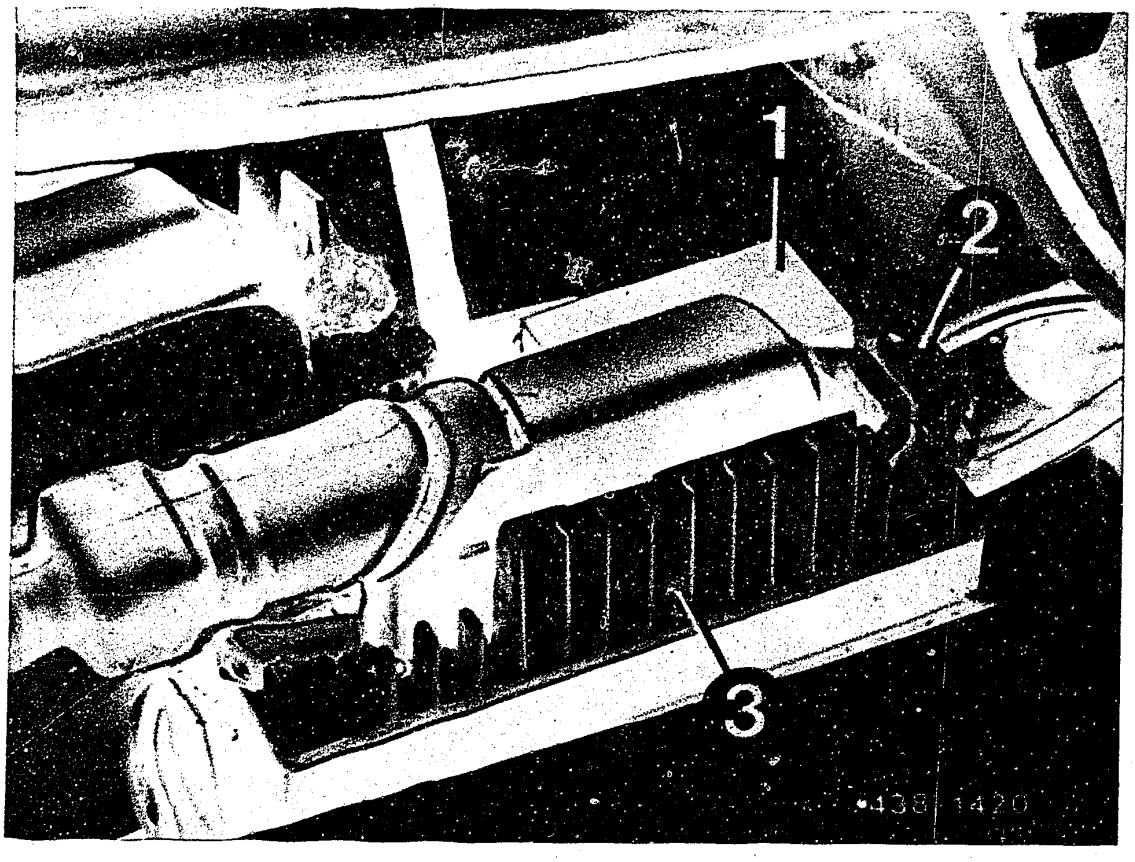
- Tool set for removing and inserting the CO anti-tamper device in the air-flow sensor
  e.g. tool set no. 4521/7 from Hazet, D-5630 Remscheid.



8. INSTALLATION POSITION OF INDIVIDUAL COMPONENTS

1 = Injection valve(s)
2 = Start valve (partially hidden)
3 = Temperature sensor (double NTC)
4 = Electro-hydraulic pressure actuator
5 = Idle throttle-valve switch
(KE-Jetronic energization)

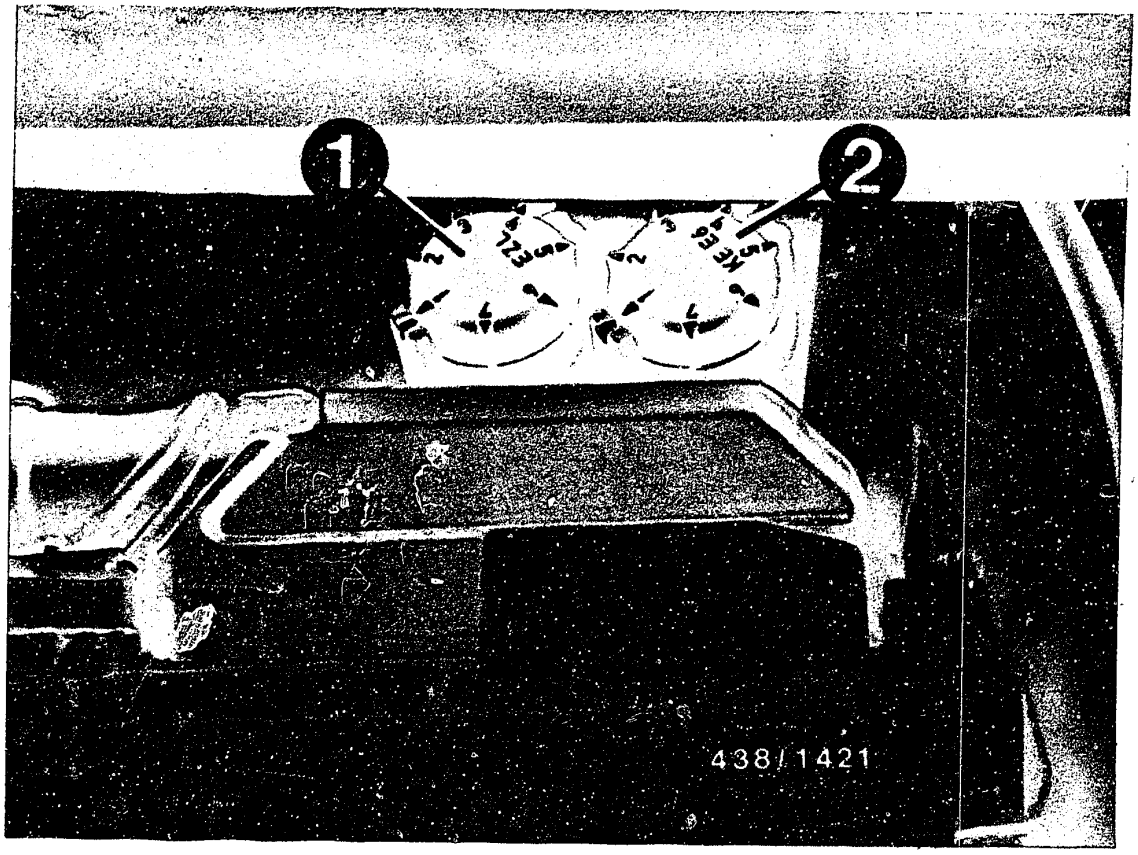
6 = Mixture-control unit
7 = Idle actuator
8 = Primary pressure regulator
9 = Idle/full-load throttle-valve switch
(Idle switch function for ignition and KE-Jetronic,
full-load switch function for KE-Jetronic)



1 = Electronic engine-speed relay for energization of electric fuel pump and start valve

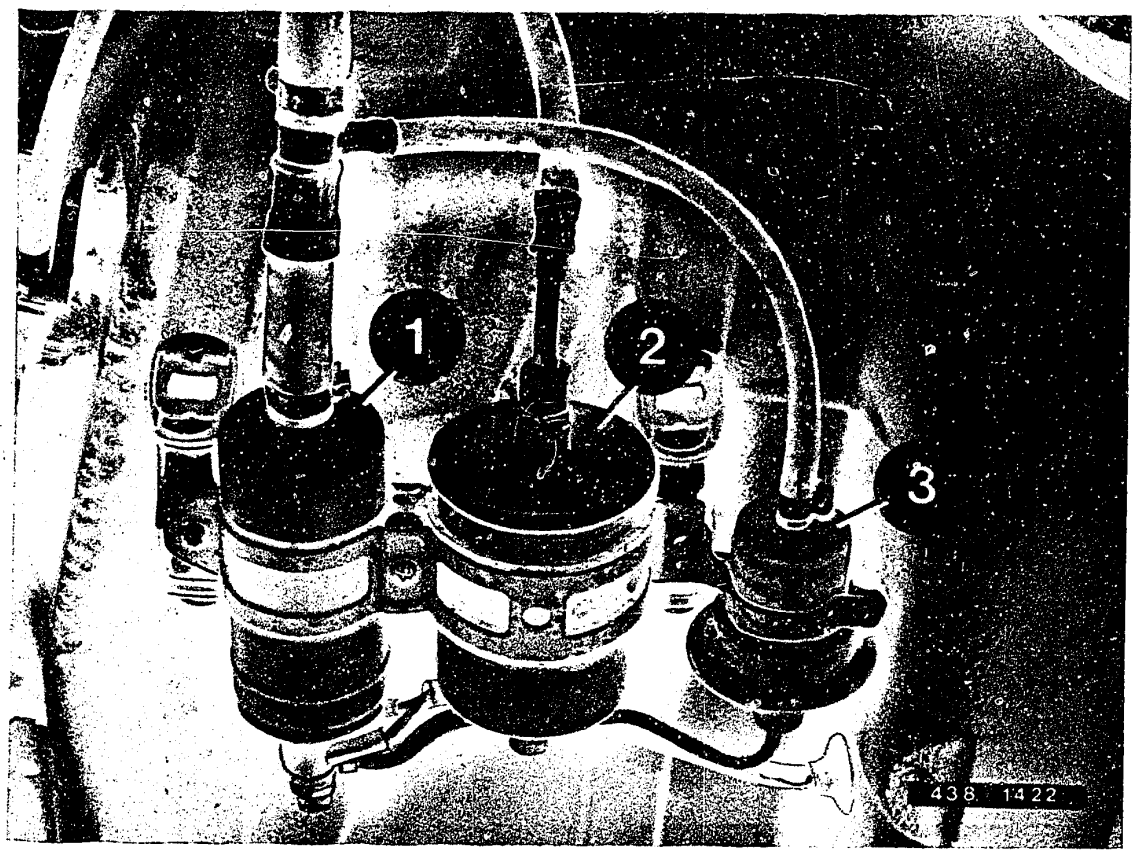
2 = Overvoltage protection relay

3 = KE-Jetronic control unit



1 = Ignition encoding plug (octane number adaptation)

2 = KE-Jetronic map adjustment encoding plug



1 = Electric fuel pump
2 = Fuel filter
3 = Fuel accumulator

The fuel-supply components are located on a common bracket, on the floor of the vehicle on the right-hand side in front of the rear axle.

A protective dirt-deflector plate has been removed for the photograph.

9. TROUBLE-SHOOTING CHART FOR THE KE-JETRONIC

Important instructions for the trouble-shooting chart below:

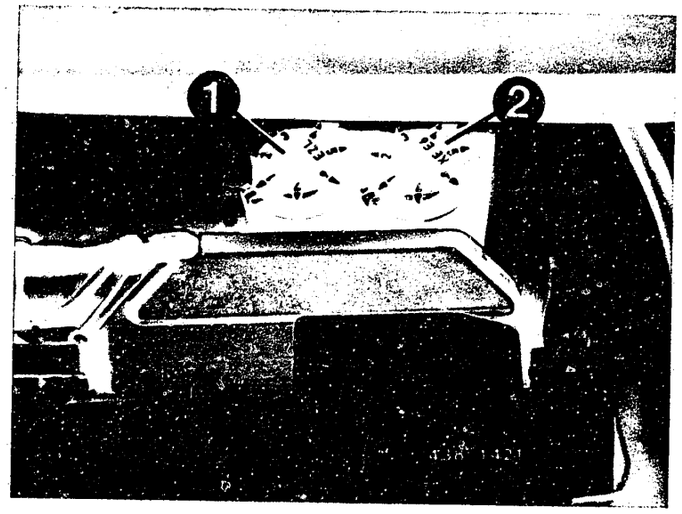
With respect to its operation, the KE-Jetronic differs in significant points from other well-known fuel-injection systems.

This makes necessary a structure for the trouble-shooting chart and a sequence for the individual test steps that are specific to the KE.

The trouble-shooting program below starts with a trouble-shooting chart (C3...C6) in which reference is made to the appropriate possible causes that correspond to the defect symptom (customer complaint).

In each cause column, reference is made to the first coordinate of the test step in which the testing of this operation is described in detail.

The trouble-shooting program has been structured in such a way that it is possible to carry out a targeted trouble-shooting with the defect being determined in principle in accordance with the trouble-shooting chart (C3..,C6).



1=Ignition encoding plug (octane number adaptation)
2=KE-Jetronic map adjustment encoding plug

Additional note:

Should it become apparent for certain symptoms that none of the possible faults in the trouble-shooting chart applies, i.e. all tests are O.K., there is a slight possibility of influencing the map by changing the position of the encoding plug (2) shown in the picture.
Plug position 1 corresponds to the factory setting. See table for effect of other positions.

Plug position	Improvement of function (x)			
	Post-start enrichment	Warm-up enrichment	Acceleration enrichment	Map
1	-	-	-	-
2	-	-	-	Leaning
3	-	-	-	x
4	-	x	-	-
5	-	x	x	-
6	-	-	x	x
7	-	x	x	x

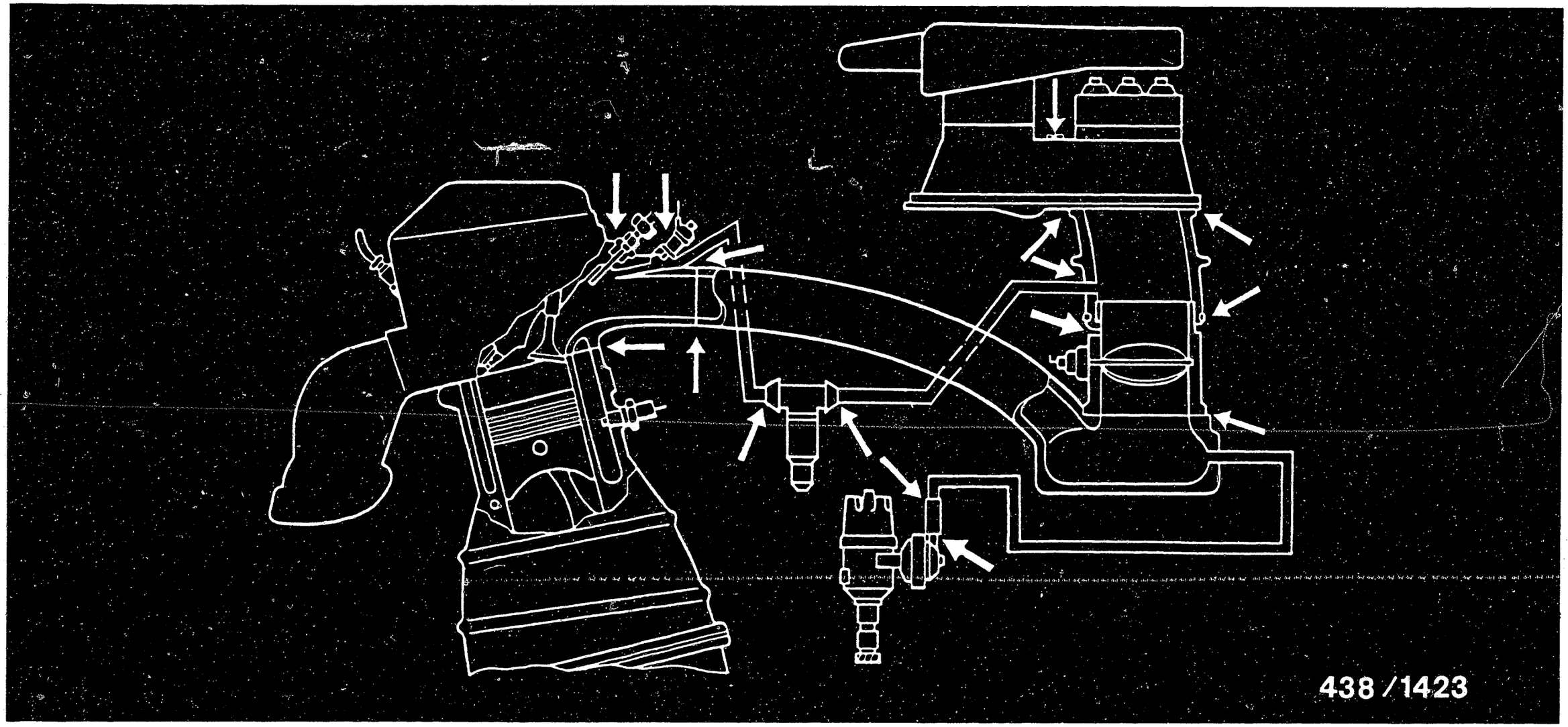
9.1 Trouble-shooting chart

Customer complaint (defect symptom)

1.	2.	3.	4.	5.	6.	7.	Cause (component defect)	Coordinates
●	●				●	●	Electric fuel pump not operating/fuel delivery too low	D 1
	●	●	●	●			Engine air intake system leaking	C 7
●	●	●	●	●			Air-flow sensor control lever or control plunger not moving freely	C 9
	●						Incorrect position of the air-flow sensor plate	C 17
●							Cold-starting system defective	D 5
		●	●				Cold-starting valve leaking	D 5
●	●				●	●	Primary pressure not within tolerance	D 9
●	●	●	●	●	●	●	Differential pressure not within tolerance	D 13
	●						Fuel system as a whole leaking	D 23
	●	●	●				Fuel-injection valves leaking, opening pressure too low	E 9
		●	●		●	●	Uneven fuel delivery (variation in deliveries)	F 1
	●	●	●	●		●	Idle-speed control defective. Air-flow sensor potentiometer defective.	G 1
						●	Throttle valve does not open fully	----
●	●						"Starting enrichment" function not within tolerance	G 1
		●					"Post-start enrichment" function not within tolerance	G 1
●		●					"Warm-up enrichment" function not within tolerance	G 1
				●			"Acceleration enrichment" function not within tolerance	G 1
					●	●	"Full-load enrichment" function not within tolerance	G 1
●	●			●			"Idle" throttle valve switch incorrectly set.	K 1

Customer complaint (defect symptom)

8. Engine "diesels"	9. Poor mileage	10. Acceleration problems	11. Idle speed incorrect or unstable	12. Engine starts, but then dies	Cause (component defect)	Coordinates
					Electric fuel pump not operating/fuel delivery too low	D 1
		●	●		Engine air intake system leaking	C 7
●		●			Air-flow sensor control lever or control plunger not moving freely	C 9
●					Incorrect position of the air-flow sensor plate	C 17
●				●	Control plunger seal (idle travel of air-flow sensor plate) incorrectly set	C 17
●	●				Cold-start valve leaking	D 5
				●	Primary pressure not within tolerance	D 9
	●	●		●	Differential pressure not within tolerance	D 13
●				●	Fuel-injection valves leaking, opening pressure too low	E 9
	●	●		●	Uneven fuel delivery (variation in delivery)	F 1
	●		●	●	Idle-speed control defective. Air-flow sensor potentiometer defective.	G 1
					"Starting enrichment" function not within tolerance	G 1
				●	"Post-start enrichment" function not within tolerance	G 1
	●	●		●	"Warm-up enrichment" function not within tolerance	G 1
		●			"Acceleration enrichment" function not within tolerance	G 1
		●			"Full load enrichment" function not within tolerance	G 1
		●			"Idle" throttle valve switch incorrectly set	K 1



10. CHECKING THE ENGINE AIR-INTAKE SYSTEM FOR LEAKS

The arrows in the diagram show typical points where leaks can occur.
Check by performing a visual inspection, or, where there are doubts, check as follows: Disconnect the hose from the outlet of the idle actuator and blow air through this hose into the intake system using a compressed air gun. Open the throttle valve fully while doing this. Brush connection points with soapy water or spray with leak detector (e.g., Güpoflex).

Combustible fluids must not be used under any circumstances to test for leaks.

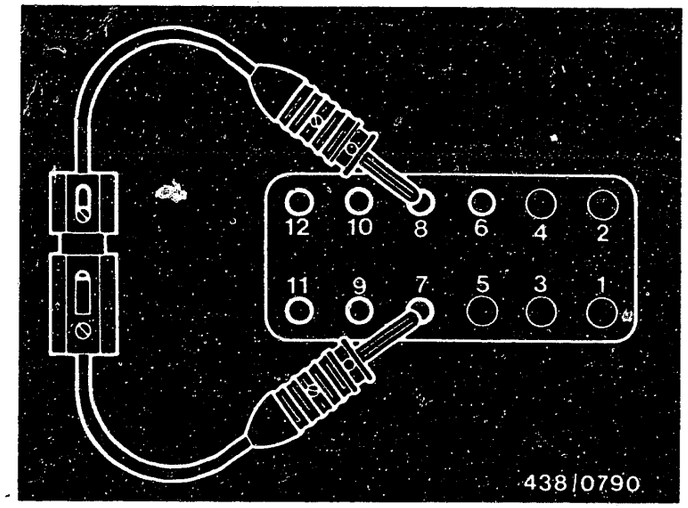
Bubbling or foaming indicates a leak.
Once a leak has been eliminated, it is necessary to conclude by adjusting the idle speed with the engine at normal operating temperature. Idle-speed adjustment is described on coordinates K 1.

11. CHECKING THE CONTROL LEVER IN THE AIR-FLOW SENSOR AND THE CONTROL PLUNGER IN THE FUEL DISTRIBUTOR FOR EASE OF MOVEMENT

Note: The sensor plate in the air-flow sensor must be flat (not arched), and must be able to pass through at the narrowest point of the air funnel without touching.

11.1 Preparations:

- Engine temperature not below + 20°C.
- Remove the air filter so that the sensor plate in the air-flow sensor is accessible.
- Turn the electric fuel pump on for a few seconds by bridging the electric safety circircuit, so that the control plunger is put under pressure. Bridge by connecting sockets 7 and 8 in the relay base using an auxiliary cable.



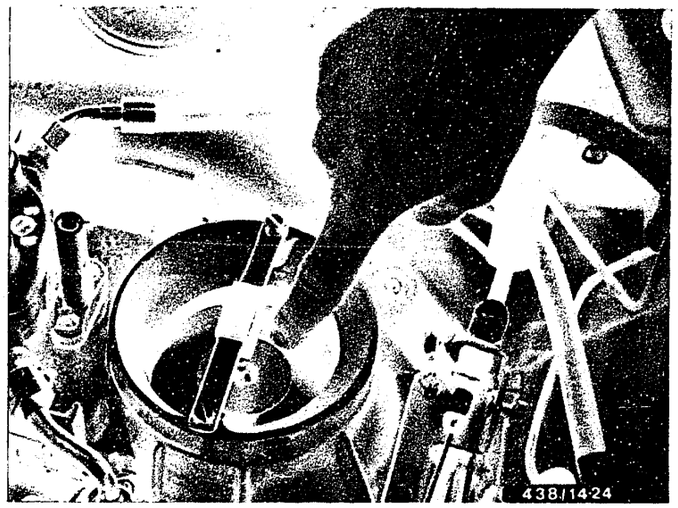
11.2 Check that the control lever moves freely:

Press the air-flow sensor plate down by hand and release it. The sensor plate snaps back into the zero position, and bounces about two more times from the spring-loaded stop.
If the control lever does not move freely, first release all fastening screws holding the air-flow sensor, in order to determine whether housing deformation is the cause of the problem. If the problem is solved by loosening the fastening screws, take out and replace the gasket between the air-supply housing and the air-flow sensor. (Daimler-Benz part). Because this requires removing the air-flow sensor, all fuel connections on the fuel distributor are to be cleaned and disconnected.

Note: When installing the air-flow sensor do not apply any sealing compound between the seal surfaces.
Tightening torque for the air-flow sensor fastening screws: 9...10 Nm.

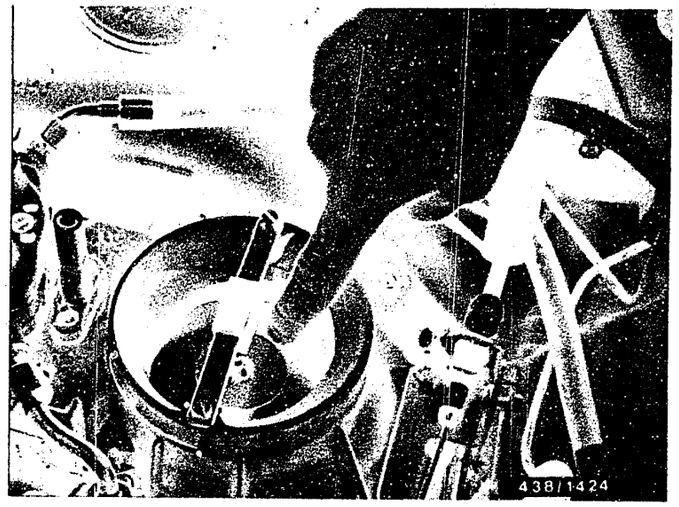
If the problem is not due to housing deformation, take out and replace the air-flow sensor.

Note: It is not possible to repair the control lever mount in the KE-Jetronic air-flow sensor.



11.3 Checking that the control plunger moves freely

Press the air-flow sensor plate down by hand. The same resistance must be felt throughout the entire movement.
Move the sensor plate back quickly to a position just in front of the zero stop. The control plunger follows only sluggishly, but must make noticeable contact with the sensor plate lever.
If the control plunger does not move freely, remove the fuel distributor from the air-flow sensor. Clean the fuel distributor thoroughly in the area near the fuel connections. Disconnect all connections. When loosening or later tightening the fuel connections, hold the fixed hex of the component with a wrench. Unscrew the three fastening screws and remove the fuel distributor from the air-flow sensor.

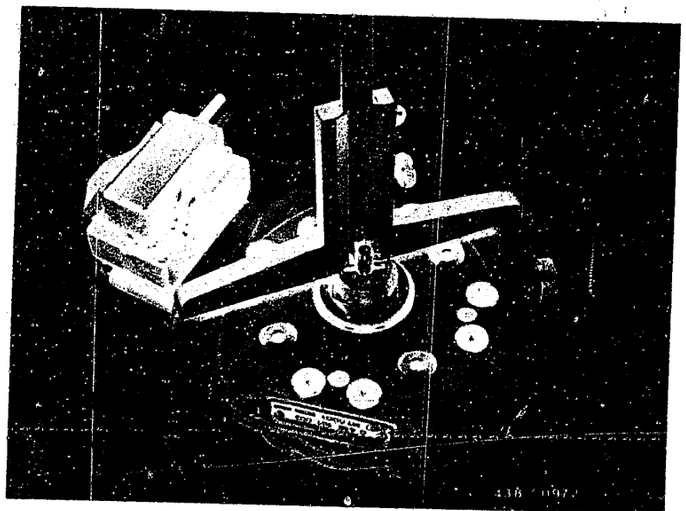


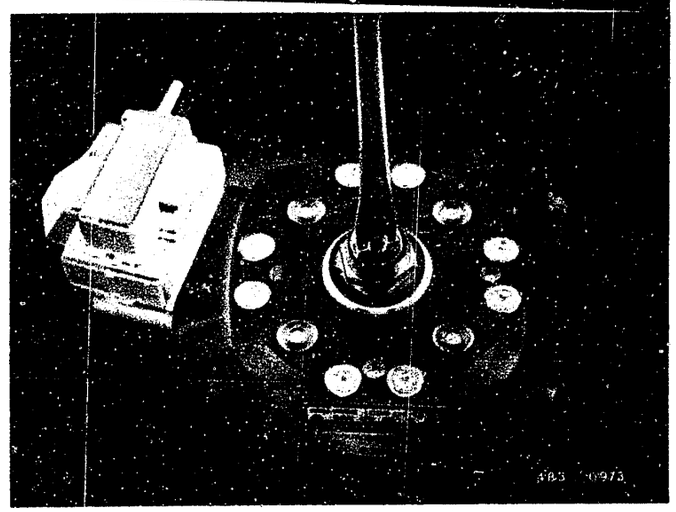
Measure the position of the slotted round nut on the lower plunger seal relative to the fastening nut on the barrel with metering slits using a depth gauge, and note it down for later re-installation. In addition, mark the rotary position of the slotted round nut. Screw out the slotted nut using a shoulder screwdriver and remove the control plunger.

Note: Do not lose the spring above the control plunger!

Clean the plunger thoroughly with benzine or the equivalent. If the plunger has severe striation, or if it is not possible to obtain easy movement by cleaning, take out and replace the fuel distributor assembly. It is not permissible to clean the control plunger by mechanical means.

After putting the spring and the plunger into the fuel distributor, screw the slotted round nut for the lower plunger seal as far as position previously determined during removal, and turn to the marking.
Put the fuel distributor back on the air-flow sensor. In so doing, use a new seal ring between the air-flow sensor and the fuel distributor. Maintain exactly the tightening torque of 3.2...3.8 Nm for the fuel distributor fastening screws.





11.4 Additional instructions for mechanical adjustment of the mixture-control unit.

Because of the lower control plunger seal in the KE-fuel distributor, it is not permissible, when the overall adjustment of the mixture-control unit is correct, for the control plunger to be in contact with the needle-roller bearing of the sensor plate intermediate lever. The sensor plate control lever must have free travel between the zero position (rest position for the sensor plate) and contact with the control plunger. In the center of the air-flow sensor plate, with the electric fuel pump running, this should be from 1...2 mm.

A correct overall adjustment of the mixture-control unit means:

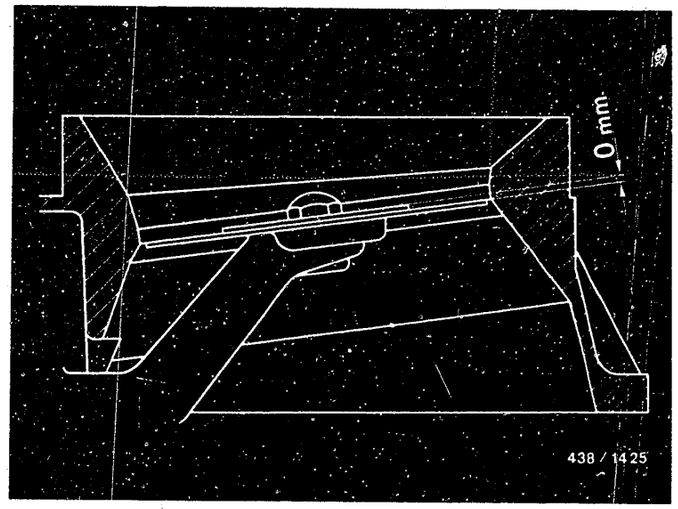
- The zero position for the air-flow sensor plate has been adjusted correctly. Check the zero position as follows.

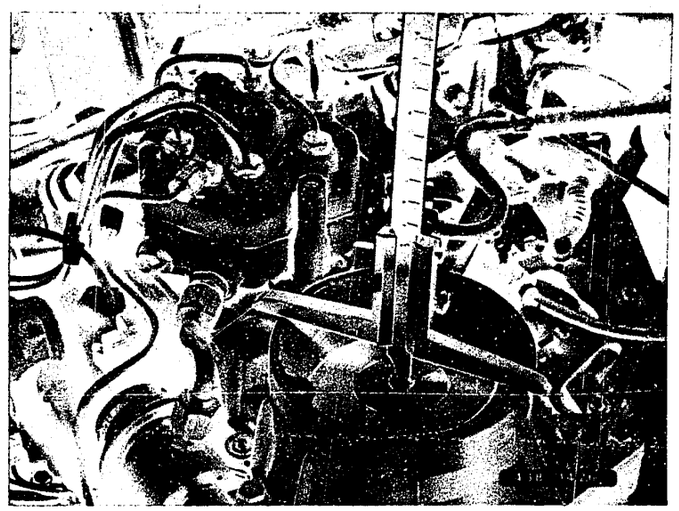
  Remove stop bracket from air funnel. Using depth gauge, fix air-flow sensor plate in basic position and measure dimension from top edge of relief funnel. Basic position (top picture):
  Top edge of the sensor plate flush with the bottom junction edge from the cylindrical zone to the air funnel. (Judged visually). Then measure the difference up to the zero position of the air-flow sensor plate. This must be between 4.2 and 4.4 millimeters.

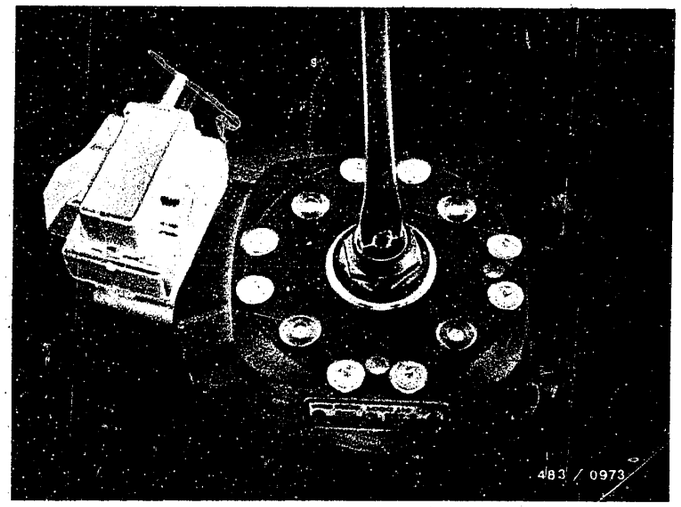
- Idle adjustment of the engine in order (Coordinates K 1).

If, despite the correct zero position of the sensor plate and despite correct idle-speed control, the required free travel is not within the value 1...2 mm, remove the fuel distributor once again and adjust the slotted round nut of the lower plunger seal, thereby adjusting the plunger position.

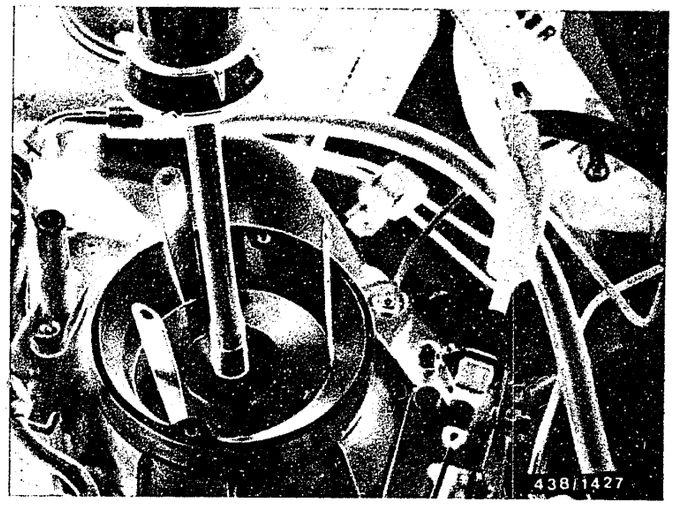
Note: Screwing the slotted round nut in by 0.1 mm produces an increase in the free travel in the center of the air-flow sensor plate of approx. 0.7 mm and vice-versa.







12. CENTERING AND ZERO POSITION FOR THE AIR-FLOW SENSOR PLATE:



12.1 Centering the air-flow sensor plate:

The sensor plate must be flat (not arched) and must be able to move through the narrowest part of the air funnel without touching.

If necessary, center the air-flow sensor plate.
To do so, remove the stop bracket. Release the sensor plate fastening screw and retighten it with 2 or 3 0.05 mm feeler gauges inserted.
Tightening torque: 5...5.5 Nm.

Important note on the sensor plate fastening screw:

To lock the screw in place, it has been micro-encapsulated in the factory, and for that reason, it is difficult to loosen or to turn. Do not use force to loosen a screw that is very tight. Instead, warm it slightly using a soldering iron.

NO OPEN FLAME!

If a screw has been loosened several times and can be turned very easily, unscrew it, clean it, and coat it with a small amount of screw locking compound (e.g., Loctite). In so doing, coat only a few threads, in order that subsequent loosening will be possible.

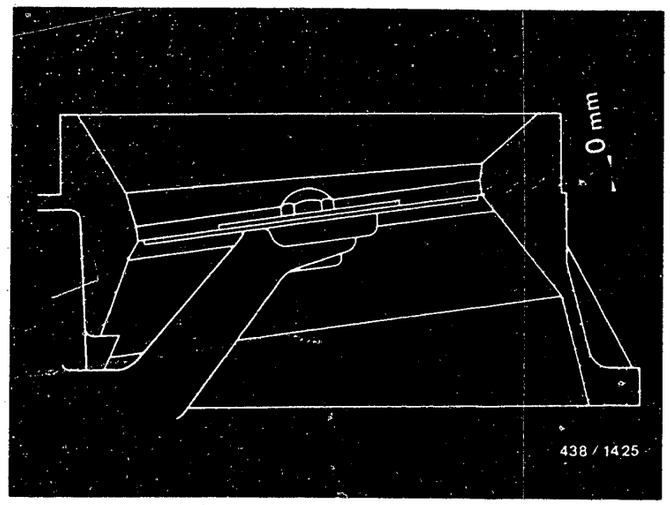
Once the screw has been tightened with the prescribed tightening torque, it must no longer be possible to turn the air-flow sensor plate by hand.

12.2 Air-flow sensor plate position (zero position)

The point of departure for determining the zero position of the air-flow sensor plate is the basic position of the air-flow sensor plate.

Definition of the basic position:

Top edge of the air-flow sensor plate flush with the bottom junction edge from the cylindrical area to the air funnel (visual assessment).



Definition of the zero position (spring-loaded stop):

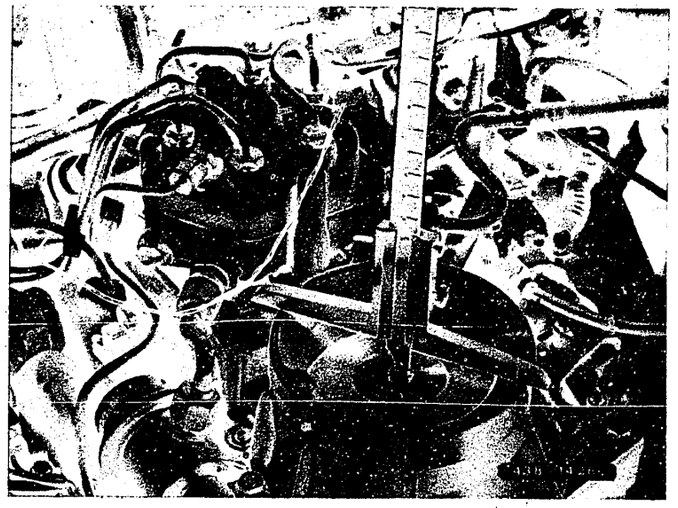
Position of the air-flow sensor plate between 4.2 and 4.4 mm higher than the basic position, measured in the center of the sensor plate.

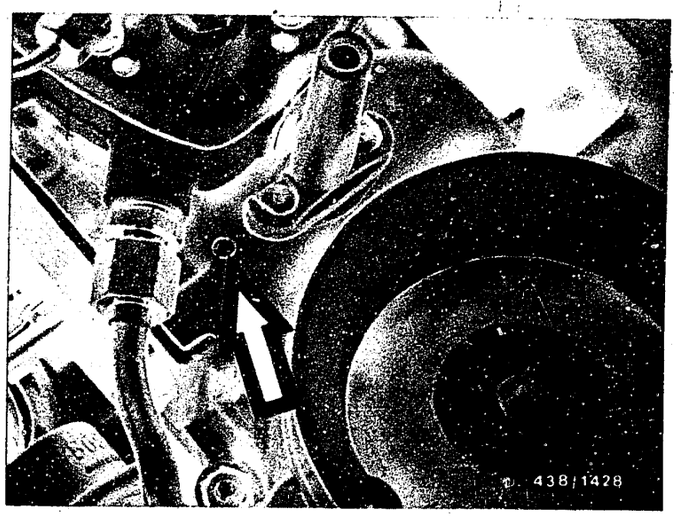
Procedure:

Using a depth gauge in the center of the air-flow sensor plate, establish the basic position with respect to the top edge of the relief funnel and take the measurement. Then measure the distance to the zero position, which must lie within the range of 4.2...4.4 mm.

If the position of the sensor plate is too high, it is possible to make an adjustment. To do this, using a mandrel and a light hammer, drive the guide pin (center picture - arrow) of the stop leaf spring correspondingly deeper.

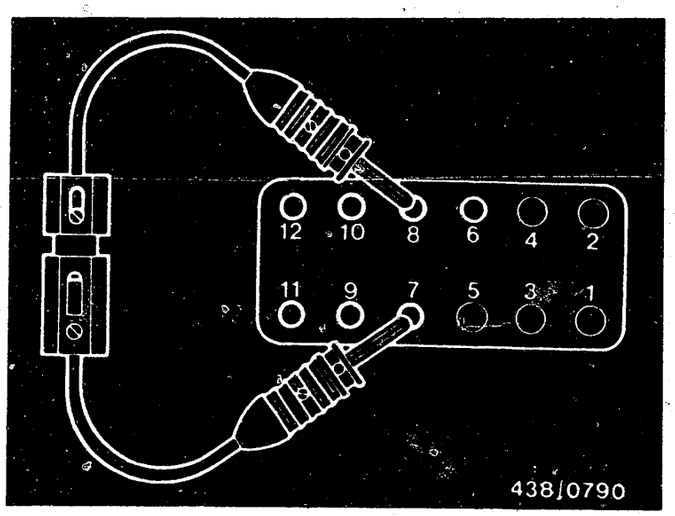
Note:
Be very careful in making this adjustment so that the guide pin is not driven in too deep. Avoid repeated adjustment in both directions, because the press fit on the pin will become inadequate. A pin that has fallen out can cause serious damage to the engine.





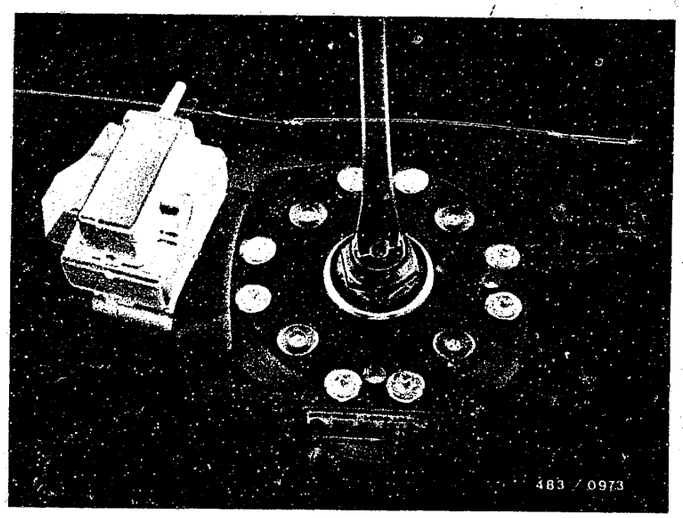
12.3 Adjusting the lower plunger seal in the fuel distributor:

Turn on the electric fuel pump by bridging the electric safety circuit, in order to put the control plunger under pressure. To do this, connect sockets 7 and 8 in the relay base using an auxiliary cable.



When the zero position of the air-flow sensor plate has been adjusted correctly, it is not permissible for the control plunger to touch the needle-roller bearing in the sensor plate intermediate lever. To check this, press the air-flow sensor plate down lightly. The sensor plate lever must have free travel between the zero position and contact with the control plunger. This free travel is to be between 1...2 mm.

For correction, remove the fuel distributor and screw the slotted round nut on the plunger seal correspondingly further in or out. Changing the depth screwed in by 0.1 mm produces about 0.7 mm in the center of the air-flow sensor plate.



Special case:

If ever the slotted round nut on the plunger seal and the idle-mixture-adjusting screw in the air-flow sensor should simultaneously be out of place by an unknown amount, the free travel can, under some circumstances, be eliminated completely or be far too great. In that case, an adjustment can be made as follows:

Remove the fuel distributor and screw back the slotted round nut, flush with the collar on the hex nut.

On the air-flow sensor, using a depth gauge, measure the dimension from the fuel distributor support (threaded eyes) to the needle-roller bearing in the control lever, and by adjusting the idle-mixture-adjusting screw, set it at 20.9...21.6 mm. Mount the fuel distributor. There is now no free travel present.

Have the engine warmed up and make the idle adjustment (Coordinates K 1).

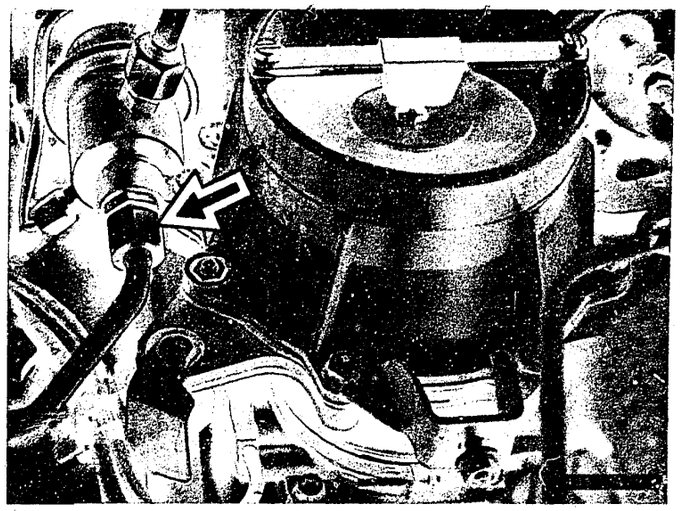
Take the fuel distributor back off and screw the slotted round nut about 0.6 mm further in. Put on the fuel distributor. With the electric fuel pump running, check the free travel. If need be, take the fuel distributor off again, and correct the slotted round nut appropriately.
Note: Changing the depth by which the slotted round nut is screwed in by 0.1 mm produces about 0.7 mm in the center of the air-flow sensor plate.

Finally connect all lines to the fuel distributor. Re-check the idle adjustment, and if need be, correct it. (Coordinates K 1).

13. CHECKING THE OPERATION OF THE ELECTRIC FUEL PUMP

13.1 Measuring point

Conclusive information on the operation of the electric fuel pump can only be given by a measurement of fuel delivery under pressure, i.e., under primary (system) pressure. For that reason, this measurement is taken at the return line connection on the pressure regulator (diagram at top - arrow).



Unscrew the fuel return line from the pressure regulator. In so doing, hold the fixed hex on the pressure regulator with a wrench. Connect a hose with a tapered connection M14 x 1.5 to the return connection on the pressure regulator. For testing, hold the hose in the crucible.

13.2 Testing

Bridging the electric safety circuit, turn the electric fuel pump on for exactly one minute and measure the fuel delivery in the graduate.
Bridge the safety circuit by connecting sockets 7 and 8 in the relay base using a connecting cable. (bottom diagram).

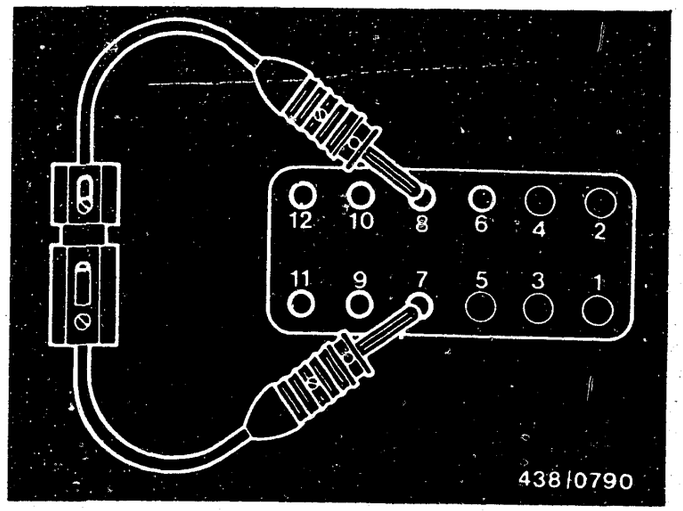
13.3 Test specification for measurement of fuel delivery

Fuel delivery: Min. 1400 cm^3/min.

13.4 Possible causes for insufficient fuel delivery

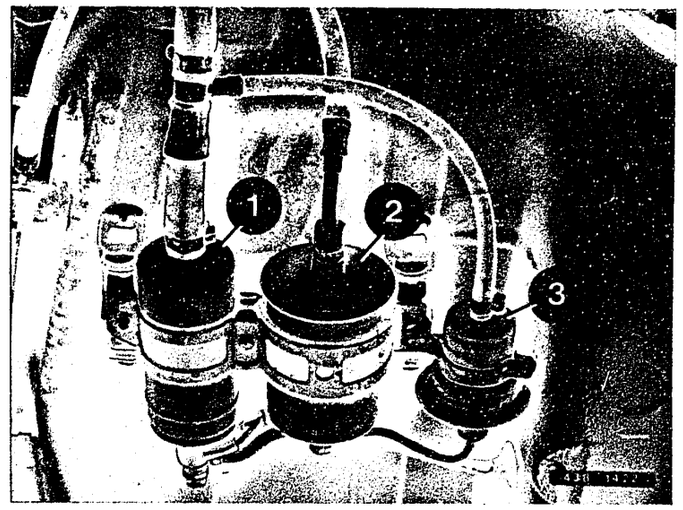
- Power supply to the electric fuel pump defective. Voltage drop.
  Minimum voltage at the connection terminals with the electric fuel pump running:
  11.5 V.
- Fuel filter very dirty.
- Filter in the double fitting in the fuel distributor inlet clogged.

If these points are in order, the fault lies with the electric fuel pump itself. Take out and replace the electric fuel pump.



13.5 Removing and installing the electric fuel pump

Pinch off the fuel intake hose (e.g., with hose clamper W 157 from Matra) and remove the suction hose on the electric fuel pump (1). Catch any fuel that flows out. Unscrew the pressure line shared by the fuel filter (2), the electric fuel pump (1), and the fuel accumulator (3). In so doing, hold the fixed hex of the components with a wrench. Take out and replace the electric fuel pump and make connections in the reverse order. Use new gasket rings when connecting the pressure line.



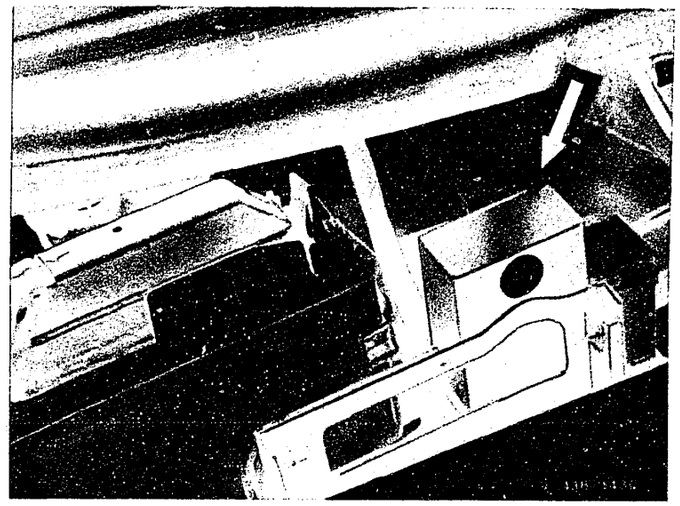
1 = Electric fuel pump
2 = Fuel filter
3 = Fuel accumulator

14. TESTING THE COLD-STARTING SYSTEM (start control relay, start valve)

14.1 Notes on operation:

The energization of the start valve is an additional function of the electronic engine-speed relay for the electric fuel pump. Energization time and threshold are temperature-dependent; the temperature signal is output as an analog voltage from the KE control unit.

The conventional thermo-time switch for energizing the start valve has been dropped.



Disconnect plugs from start valve and temperature sensor (NTC).

Measure voltage at start valve plug while operating the starting motor.

Reading: 8...12 V.

Voltage obtained?

no →

Disconnect energization relay (electric fuel pump/cold-start control) (top picture - arrow) from relay base and, with ignition on, measure voltage at terminal "TF" - socket 2. Lead disconnected from temperature sensor (NTC).

Reading = approx 4 V.

Reading with NTC lead connected and engine temperature approx +20°C: approx 2 V.

Reading with NTC lead connected and engine at normal operating temperature: approx 0.3 V.

If reading 0 V: open circuit in lead to pin 9 - KE control unit, or control unit defective.

Reading incorrect: control unit defective.

Eliminate open circuit or replace control unit.

yes

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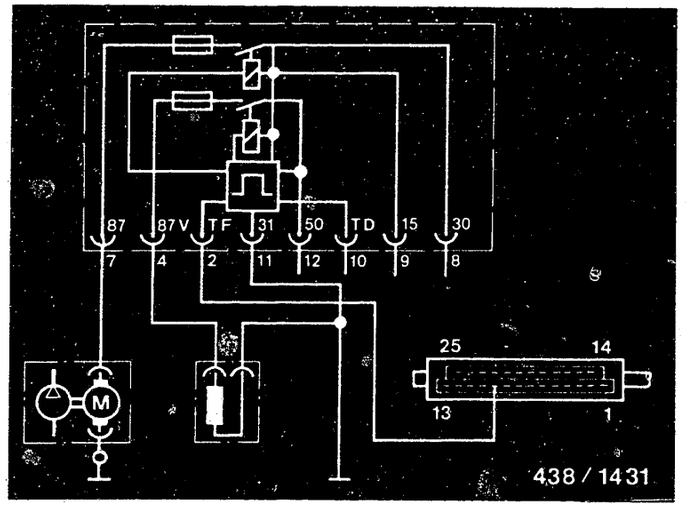
Continued on next picture page



Testing the cold-starting system (continued)

yes

Check all other lead connections on relay base:

Term. 30 (socket 8) from engine cable connector.
Term. 15 (socket 9) from engine lead set plug connector, pin 1; switch on ignition.
Term. 50 (socket 12) from engine cable set plug connector, pin 7; operate starting motor.
Term. TD (socket 10) from ignition trigger box term. TD.
Term. 31 (socket 11) ground.
Term. 87 V (socket 4) to start valve.

Eliminate open circuit, if applicable.

Energization relay defective.
Replace energization relay.

Remove start valve and re-connect via flexible hose line to original connection on fuel distributor.

Suitable hose line: from connecting-parts set KDJE-P 100/11.

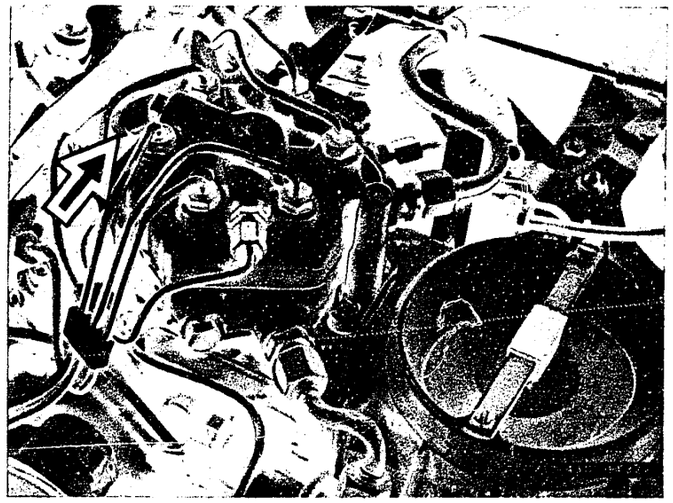
Connect electrical lead. Disconnect plug from temperature sensor (NTC).

Hold start valve in container (e.g. measuring glass). Operate starting motor. The valve must squirt fuel for approx 8 seconds, finely atomized, in a uniform conical shape.

no

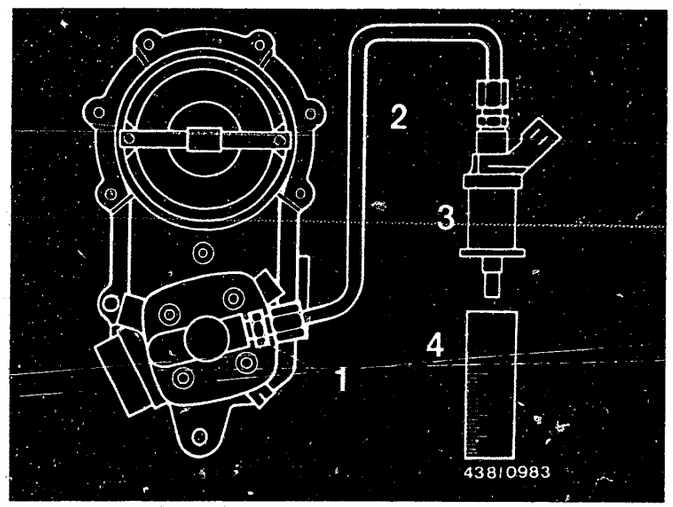
Start valve defective.

Replace start valve.



Arrow = Start valve

1 = Double threaded fitting M 8x1/M 12x1.5
2 = Hose line from KDJE-P 100/11
3 = Start valve
4 = Measuring glass



15. PRESSURE MEASUREMENT

15.1 Primary pressure

Mounting pressure tester KDJE-P 100

Connect with connecting-parts sets KDJE-P 100/10 and .../11.

For connecting the pressure tester, the fuel distributor has 2 special measuring connections which are closed by screw plugs when in operation.

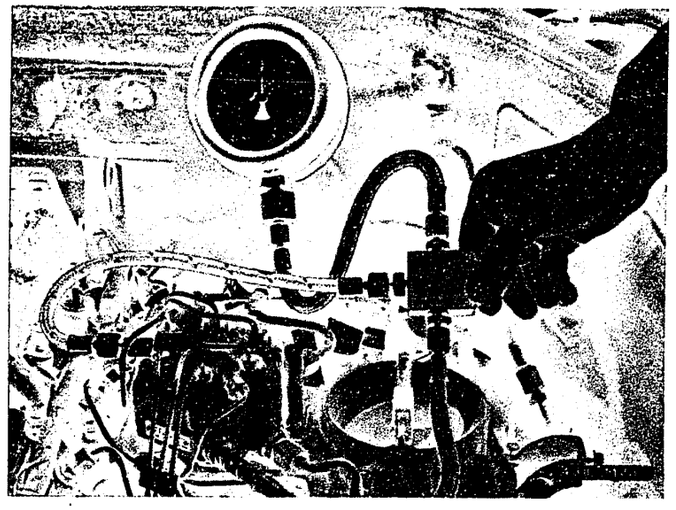
Caution: to reduce the pressure, always first of all loosen the upper screw plug.

Connect connection "A" of the directional-control valve with double threaded fitting M 8 x 1/M 10 x 1 and hose line from KDJE-P 100/11 to the bottom connection (bottom part of housing).

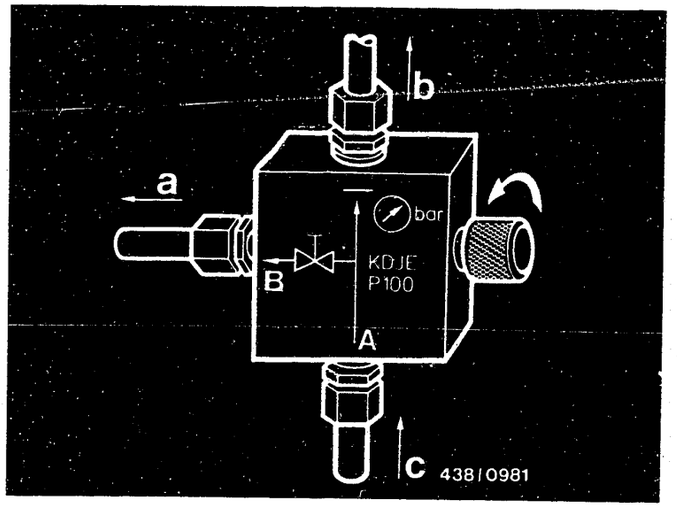
Connect connection "B" with double threaded fitting M8 x 1/M 12 x 1.5 to the upper connection (top part of housing).

Testing the primary pressure:

Open valve screw on directional-control valve (turn counterclockwise).



a = To upper measuring connection on fuel distributor
b = To pressure gauge
c = To bottom measuring connection on fuel distributor



Turn the electric fuel pump on by bridging the electric safety circuit. To do this, bridge sockets 7 and 8 in the relay base using a connecting cable.

The pressure gauge on the pressure tester shows the primary pressure.

Test specification for primary pressure: 5.25...5.6 bar gauge pressure.

Possible causes if the primary pressure is too low:

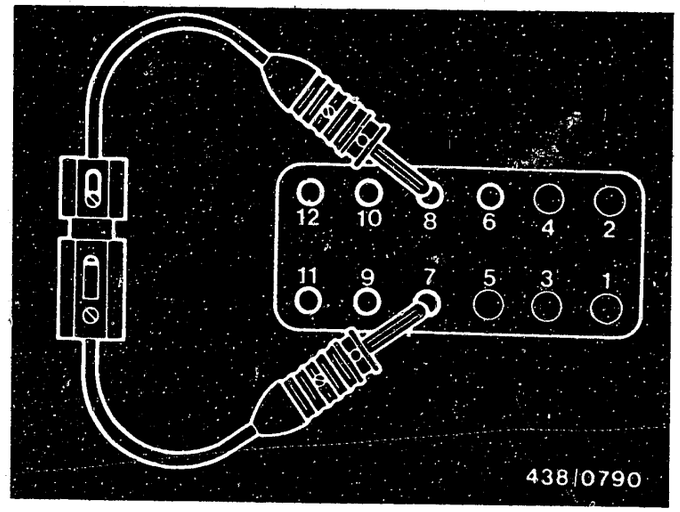
- Fuel supply system not in order. Fuel delivery of the electric fuel pump insufficient.
  Measure the fuel delivery at the return connection on the pressure regulator.
  Test specification: Min. 1400 cm³ per minute.

- Pressure regulator for primary pressure not in order.
  Take out and replace the pressure regulator.

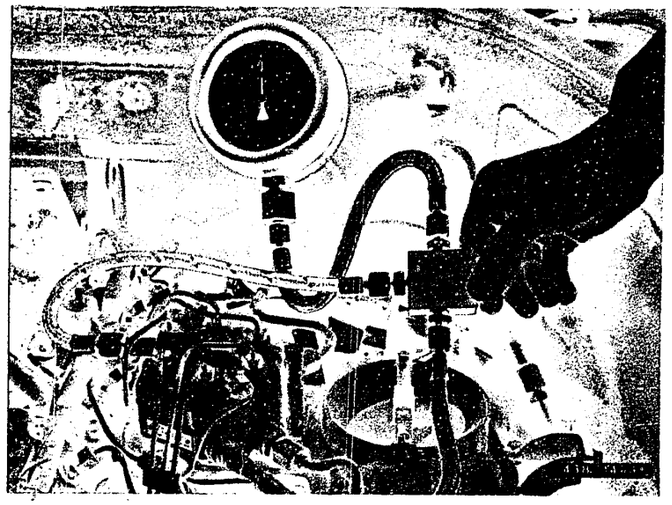
Possible causes if the primary pressure is too high:

- Fuel return to the fuel tank is being constricted.
  To check this, direct the return from the pressure regulator into a separate container.

- Pressure regulator for the primary pressure is not in order.
  Take out and replace the pressure regulator.



15.2 Checking the differential pressure



The basic coordination of the KE-Jetronic and the electronically controlled correction functions are accomplished using differential pressure control. The differential pressure (difference in pressure between the primary pressure and the pressure in the lower chambers of the differential pressure valves in the fuel distributor) is determined by the operation of the electrohydraulic pressure actuator mounted on the fuel distributor.

The electrical and the hydraulic functioning of the pressure actuator is evaluated by means of the differential pressure measurement below. If this functioning is in order, possible defects in the correction function can be due only to problems in the sector controlling the pressure actuator.

Because the differential pressure is measured dependent on the triggering current to the pressure actuator, the universal test adapter with the multimeter is to be connected up for this procedure.

Mounting pressure tester KDJE-P 100

Connect with connecting-parts sets KDJE-P 100/10 and .../11.

For connecting the pressure tester, the fuel distributor has 2 special measuring connections which are closed by screw plugs when in operation.

Caution: to reduce the pressure, always first of all loosen the upper screw plug.

Connect connection "A" of the directional-control valve with double threaded fitting M 8 x 1/M 10 x 1 and hose line from KDJE-P 100/11 to the bottom connection (bottom part of housing).

Connect connection "B" with double threaded fitting M8 x 1/M 12 x 1.5 to the upper connection (top part of housing).

Connecting the universal test adapter

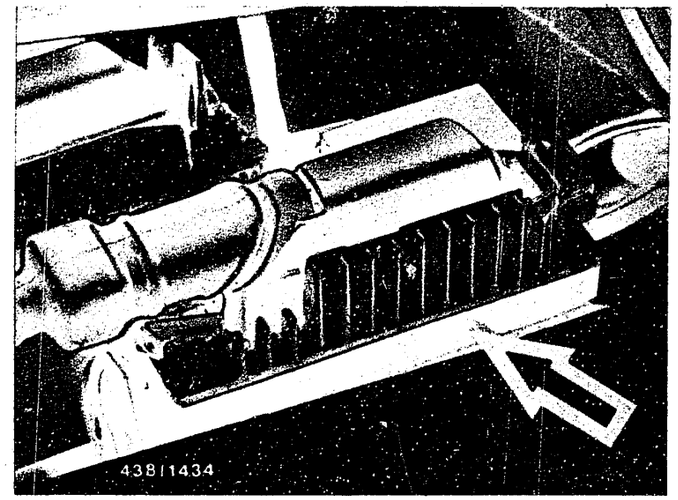
Slide KE control unit (arrow) upward in mounting and remove.

Remove the multiple plug on the control unit. (Push back the detent and hinge the plug up on the detent side first). Connect the lead plug to the edge connector for the test cable of the universal test adapter.

Connect the test lead multiple plug to the control unit.

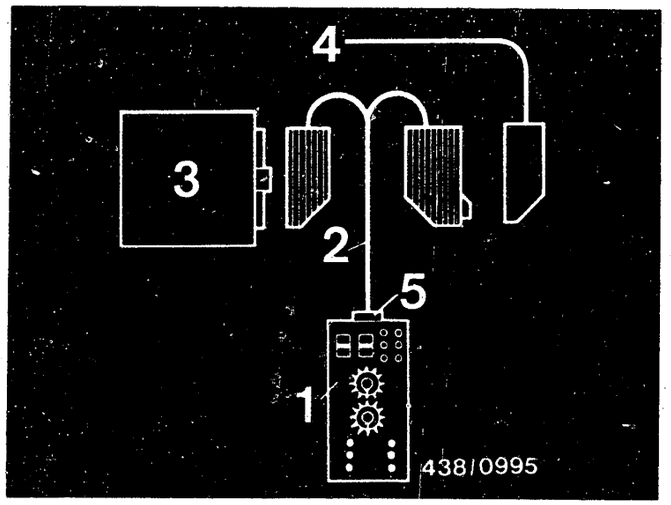
Connect the test lead to the universal test adapter across the pin terminal.

Connect ammeter to the black sockets (A) on the universal test adapter in accordance with manufacturer's instructions.
Ammeter; e.g. BOSCH-Motortester, MOT 300/400 with shunt 1 684 503 098, or commercially available e.g. Flunke - Multimeter 75.



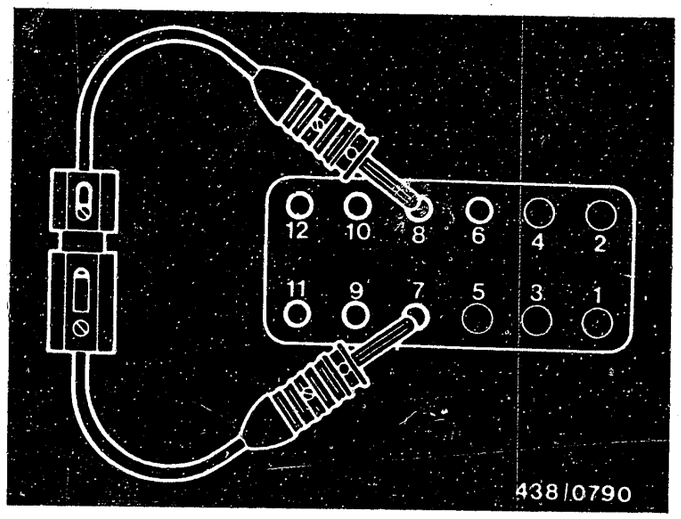
Arrow = KE control unit

1 = Universal test adapter
2 = System adapter lead
3 = Control unit
4 = System-wiring harness
5 = Pin terminal



Procedure

Turn the electric fuel pump on by bridging the electric safety current. To do so, bridge sockets 7 and 8 in the relay base.



Open the valve screw of the directional-control valve on the pressure tester (turning counter-clockwise).

The pressure gauge now shows the primary pressure.

Test specification: 5.25 ... 5.6 bar gauge pressure

Note down the value as measured.

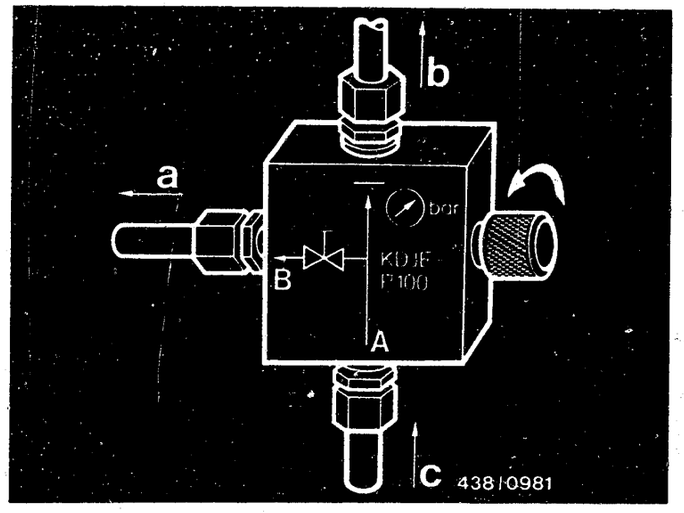
Possible causes for incorrect results in measurement:

- Fuel supply system defective. Deliveries from electric fuel pump insufficient.

  Test specification: Min. delivery 1400 cm^3/min.

- Fuel return line to the fuel tank constricted. To check this, unscrew the return line on the pressure-regulator for primary pressure and direct the return flow into a separate container.

- Pressure regulator for primary pressure is not in order. Take out and replace the pressure regulator.



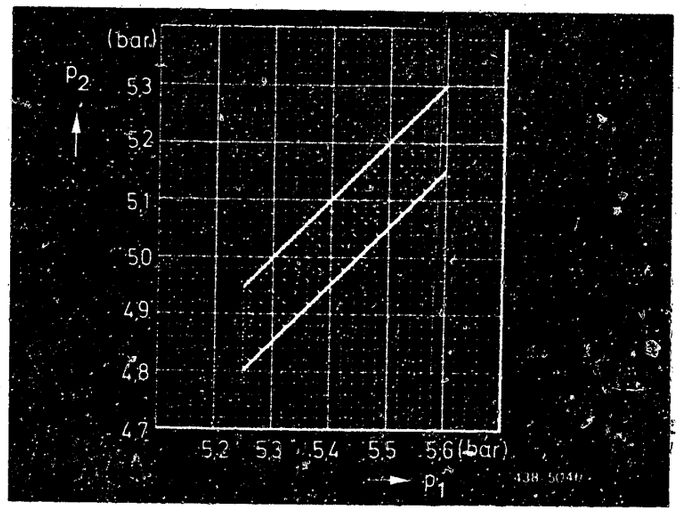
Measuring the "warm" lower-chamber pressure:

Remove the plug from the electrohydraulic pressure controller (controller current 0 mA).

Close the hollow screw of the directional-control valve (turn in a clockwise direction).

The pressure indicated on the pressure gauge must drop below the previously noted primary pressure.

Calculate the "warm" lower-chamber set-value pressure from the graph in accordance with the measured primary pressure.



P_1 = Primary pressure
P_2 = Lower-chamber pressure
Controller current = 0 mA

Possible causes of reading being incorrect:

- Fuel decoupling restriction in fuel distributor clogged. For testing, measure the overflow quantity:

  Unscrew thin fuel line to pressure regulator on fuel distributor and seal off (bottom picture - arrow). Connect hose line with ball connector M 10 x 1 to the free connection port and measure overflow quantity.

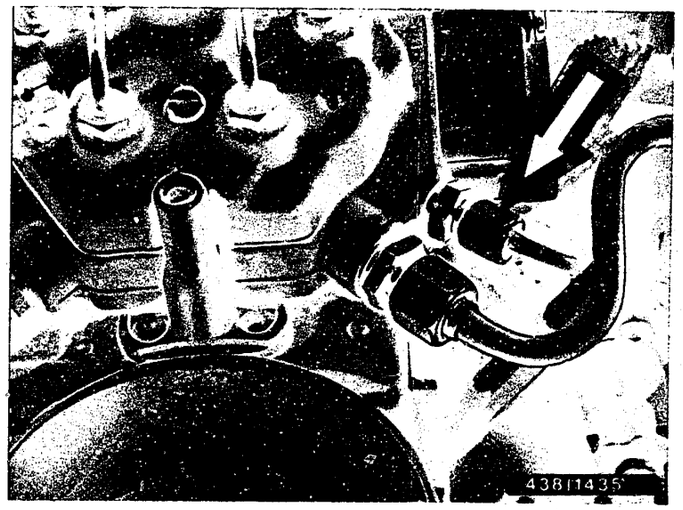
  Test specification: 130...150 cm^3/min.

  If this value is not reached, replace the fuel distributor.

- Electrohydraulic pressure controller defective. Replace pressure controller.

  To do this, clean the fuel distributor in the region of the pressure controller. The new pressure controller is only supplied as a parts set with new seal rings and fastening screws. Always mount the pressure controller with new seal rings and the original fastening screws (non-magnetic steel).

Arrow = Fuel line to pressure regulator



Measuring the "cold" lower-chamber pressure:

Connect the plug to the electrohydraulic pressure controller.

Hollow screw of directional-control valve remains closed (turned in a clockwise direction).

Set the ammeter to the 0... 100 mA measuring range.

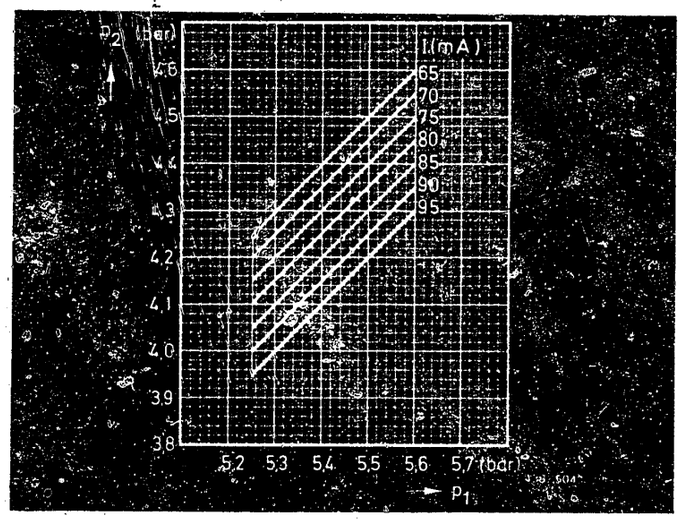
Switch on the ignition.
Press button 3 on universal test adapter and hold.

Calculate the required lower-chamber set-value pressure from the graph in accordance with the controller current now indicated by the ammeter and in accordance with the previously measured primary pressure.

Note the tolerance of ± 0.15 bar which must be added to each characteristic curve.

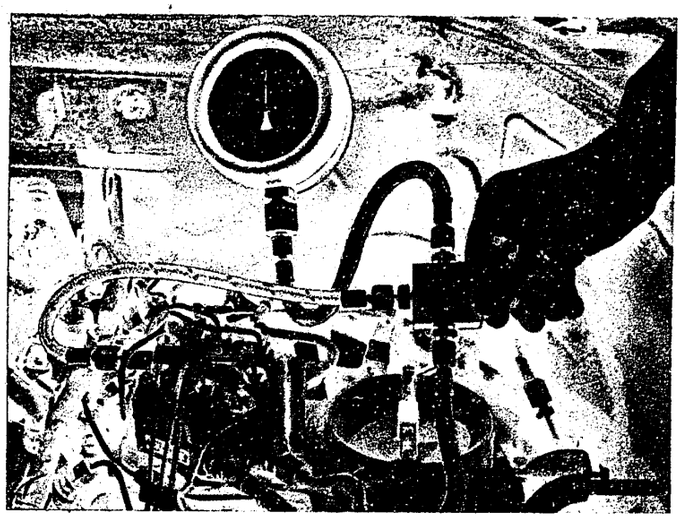
If the pressure is above or below the required lower-chamber set-value pressure, the cause lies with the electrohydraulic pressure controller. Replace the pressure controller.

To do this, clean the fuel distributor in the region of the pressure controller. The new pressure controller is only supplied as a parts set with seal rings and fastening screws. Always mount the pressure controller with new seal rings and original fastening screws (non-magnetic steel).



P_1 = Primary pressure
P_2 = Lower-chamber pressure "cold" Tolerance ± 0.15 bar
I = Controller current

15.3 Checking the overall fuel system for internal leaks



Mounting pressure tester KDJE-P 100

Connect with connecting-parts sets KDJE-P 100/10 and ...11.

For connecting the pressure tester, the fuel distributor has 2 special measuring connections which are closed by screw plugs when in operation.

Caution: to reduce the pressure, always first of all loosen the upper screw plug.

Connect connection "A" of the directional-control valve with double-threaded fitting M 8 x 1/M 10 x 1 and hose line from KDJE-P 100/11 to the bottom connection (bottom part of housing).

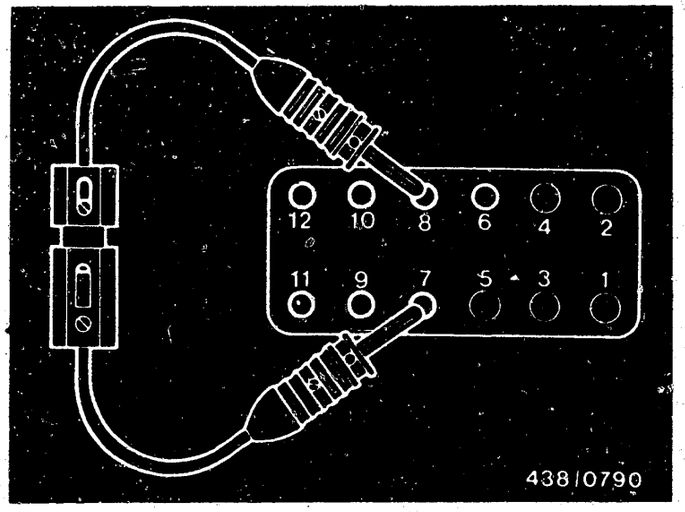
Connect connection "B" with double threaded fitting M8 x 1/M 12 x 1.5 to the upper connection (top part of housing).

Switch on electric fuel pump by jumping the electrical safety circuit. To do this, jump sockets 7 and 8 in the relay base (bottom diagram) until primary pressure has built up. Then switch off again. Observe pressure drop on pressure gauge.

Test specifications for leak test:

Minimum pressure after 10 minutes: 2.7 bar gauge pressure

Minimum pressure after 20 minutes: 2.6 bar gauge pressure



Possible causes of leaks (pressure reduction too fast):

- Start valve leaking.

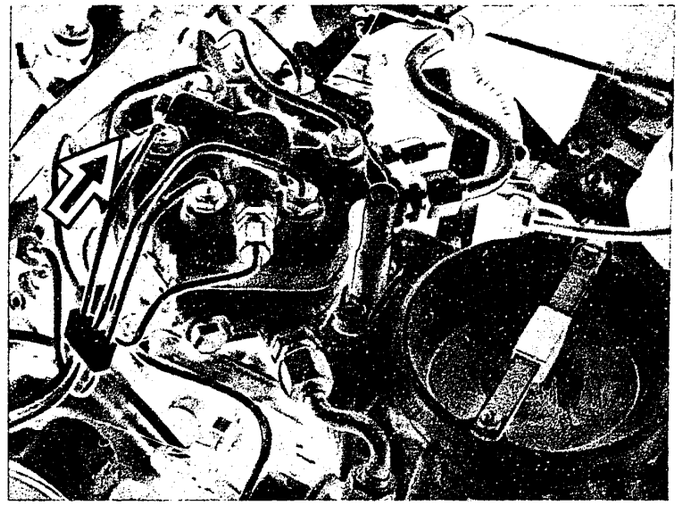
  Remove start valve (top picture - arrow) for testing. To loosen the fuel line, hold the hexagonal section of the double threaded fitting with a wrench.

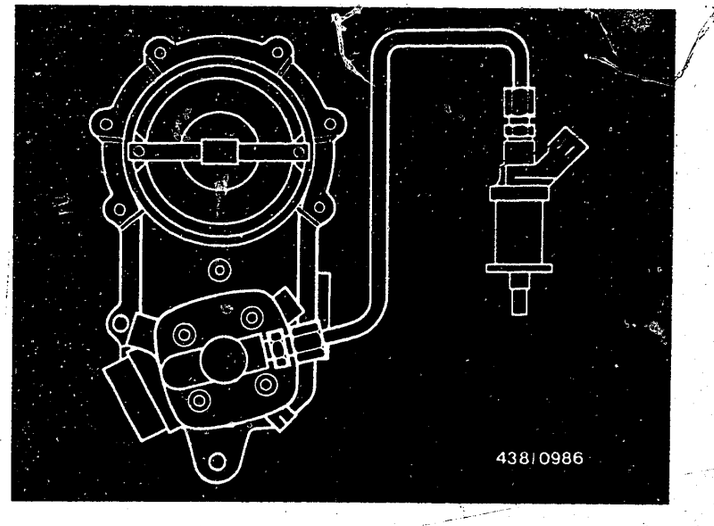
  Likewise unscrew the fuel line to the start valve on the fuel distributor.

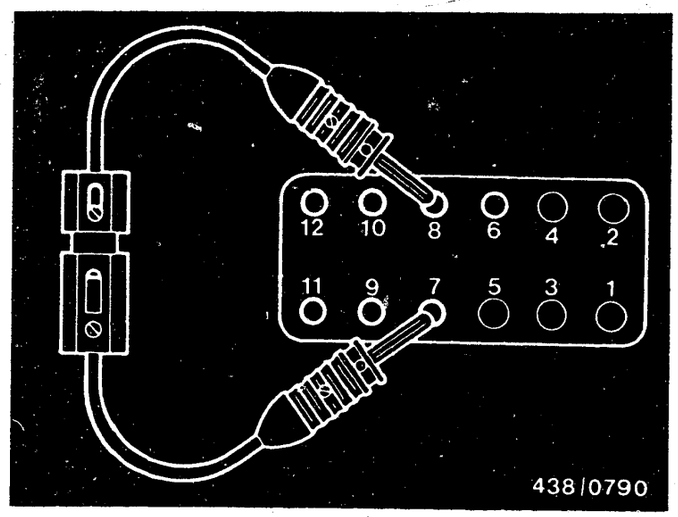
  Switch on the electric fuel pump by bridging the electrical safety circuit. To do this, bridge pins 7 and 8 in the relay base (bottom diagram).

  No drops must fall from the nozzle of the start valve within the next minute. Even when shaken and knocked, the start valve must not leak.

  If the start valve has had to be replaced due to leaking, the idle adjustment must then be checked and, if necessary, corrected.
  The idle adjustment is described on Coordinate K 1.

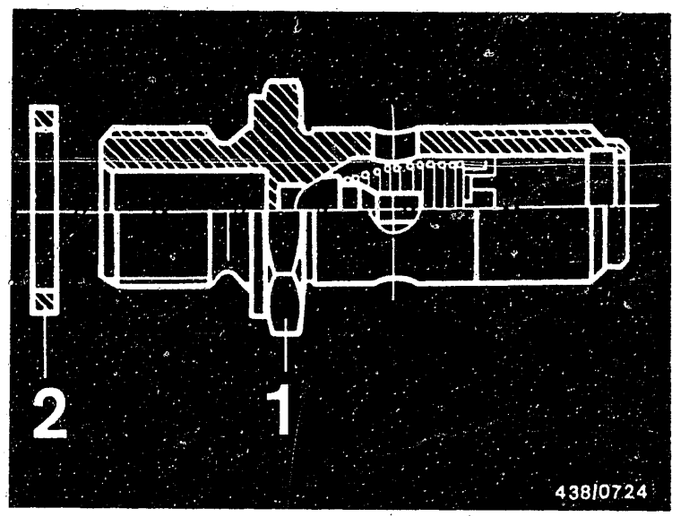






- Non-return valve in tube fitting on delivery side of electrical fuel pump leaking.

  For testing, pinch off intake line of electric fuel pump (e.g. using hose clamper W 157 from Matra Co.) and repeat leak test. If the leak is now eliminated, replace the tube fitting.
  The new tube fitting (1) is supplied with the corresponding seal ring (2) as a parts set under the part number 1 587 010 006.



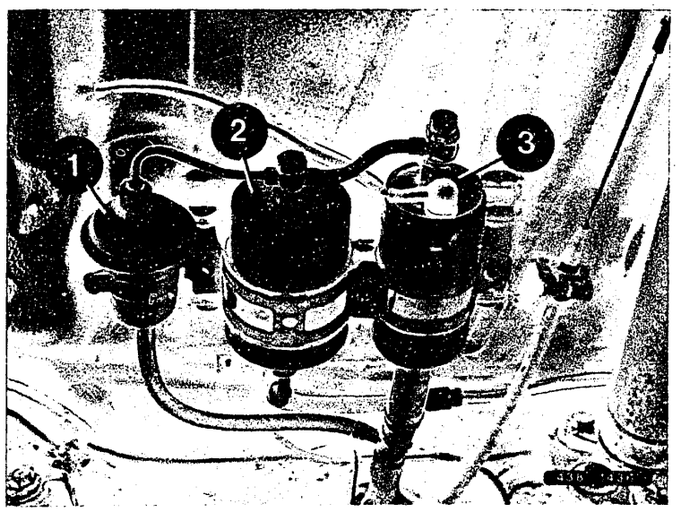
1 = Tube fitting
2 = Seal ring

Replacing the tube fitting:

Pinch off the intake hose of the electric fuel pump again.

Unscrew the common delivery line from the fuel accumulator (1), electric fuel pump (3) and fuel filter (2).
Apply counter-force at the fixed hexagon. Unscrew the tube fitting and secure the new tube fitting to a tightening torque of 10...16 Nm. Remount the common delivery line.
Use new seal rings for the tube fitting and inlet union.

1 = Fuel accumulator
2 = Fuel filter
3 = Electric fuel pump



• Diaphragm-type primary pressure regulator leaking.

For testing, unscrew return connection (top picture, arrow) from pressure regulator and seal off tight.

Important:

In order, during this test, to prevent damage to individual components (e.g. pressure actuator), make sure that no pressure greater than the primary pressure can build up. For this reason, jump the safety circuit only briefly (one touch!).

If the leak is now remedied, replace pressure regulator.

• Seal rings of lower plunger seal in fuel distributor leaking.

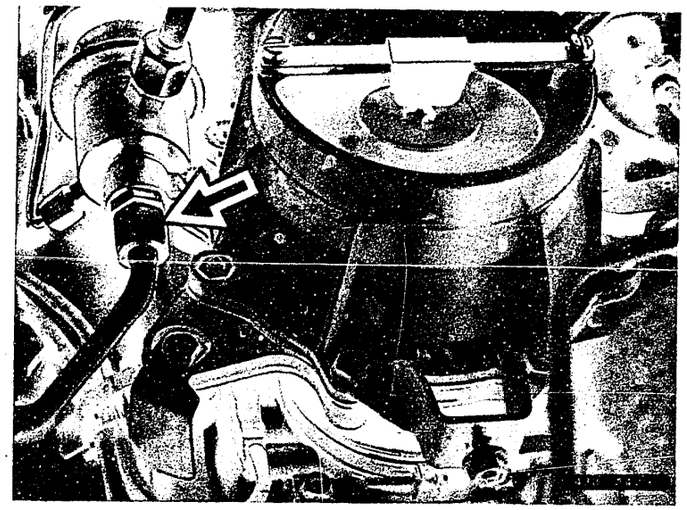
Clean fuel distributor. Unscrew fuel connections from fuel distributor and remove fuel distributor from air-flow sensor.

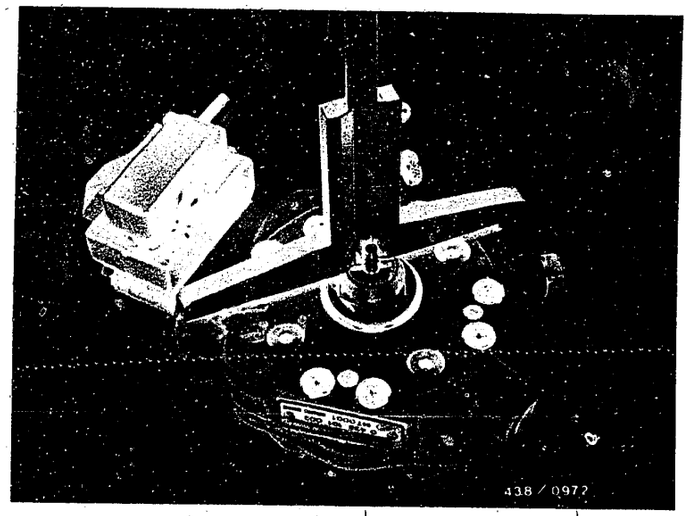
Using depth gauge, measure position of slotted round nut of plunger seal in relation to fastening nut of barrel with metering slits and note down for subsequent re-installation (center picture). In addition, mark rotary position of slotted round nut.

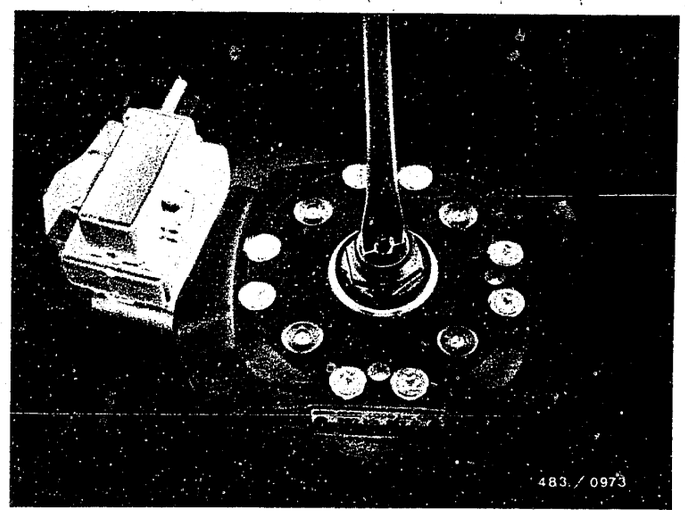
Unscrew slotted round nut with shoulder-type screwdriver (bottom picture).

Carefully change shaped seal ring of slotted round nut (do not damage).
Screw in slotted round nut as far as position found when removing and turn to mark.

Remount the fuel distributor on the air-flow sensor. Insert a new seal ring between air-flow sensor and fuel distributor.
Observe precisely the tightening torque for the fuel distributor fastening screws: 3.2...3.8 Nm.

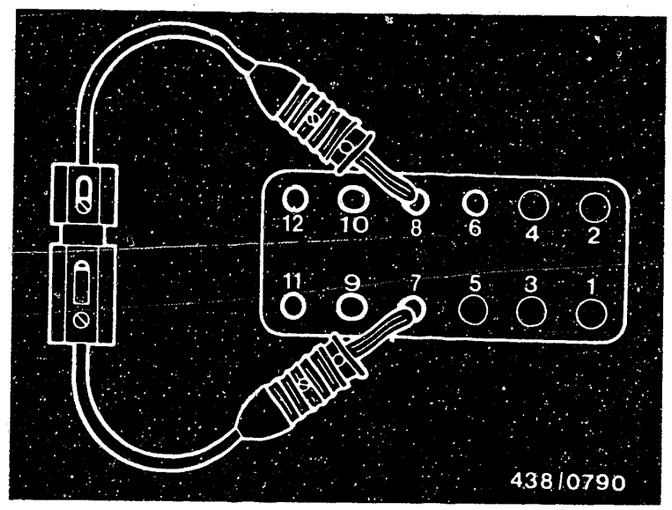






Checking the adjustment of the bottom plunger seal (slotted round nut):

Switch on the electric fuel pump for a few seconds by bridging the electrical safety circuit so that pressure is applied to the control plunger. To do this, bridge pins 7 and 8 in the relay base (picture).



If the position of the air-flow sensor plate is correctly adjusted, the control plunger must not rest on the needle bearing in the air-flow sensor plate intermediate lever. To check, press the sensor plate slightly downward. The air-flow sensor plate lever must have free travel between the zero position and the point at which the control plunger touches. The free travel should be approx. 2 mm measured at the centre of the sensor plate.

If this condition is not met, the fuel distributor must be removed once again - and the position of the slotted round nut must be corrected accordingly.

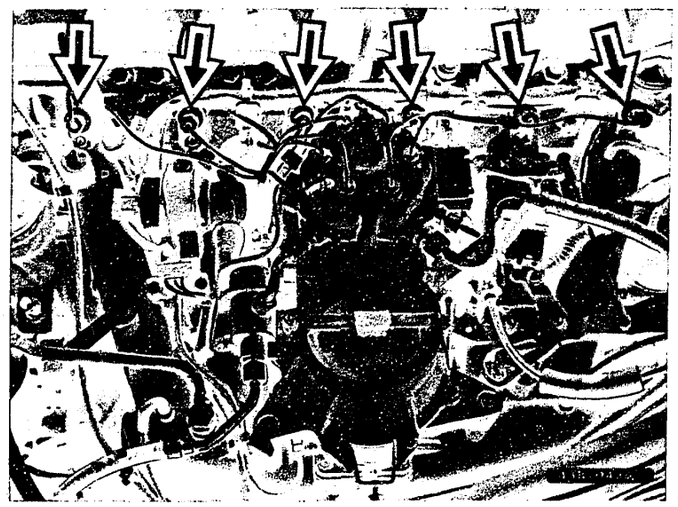
If the free travel is insufficient, screw in the slotted round nut further, and vice versa.

Changing the plunger position/slotted round nut by 0.1 mm corresponds to approx. 0.7 mm at the centre of the air-flow sensor plate.

16. TESTING THE INJECTION VALVES

Remove the injection valves for testing.
When loosening the fuel lines, apply counter-force at the fixed hexagon of the injection valves. We recommend loosening the fuel-injection tubing at the fuel-distributor as well. The steel fuel-injection tubing must not be bent.

When refitting the injection valves, it is best to replace the O-rings on the valve stem (Mercedes-Benz service part) in order to prevent leaks and thus the entry of unmetered air.



arrow = injection valves

16.1 Test equipment and test media

The following testing specification refers to valve testers KDJE-P400 (previously KDEP 7452) and 0 681 200 700.

Observe the test-media specification!

Test media: Test gasoline.

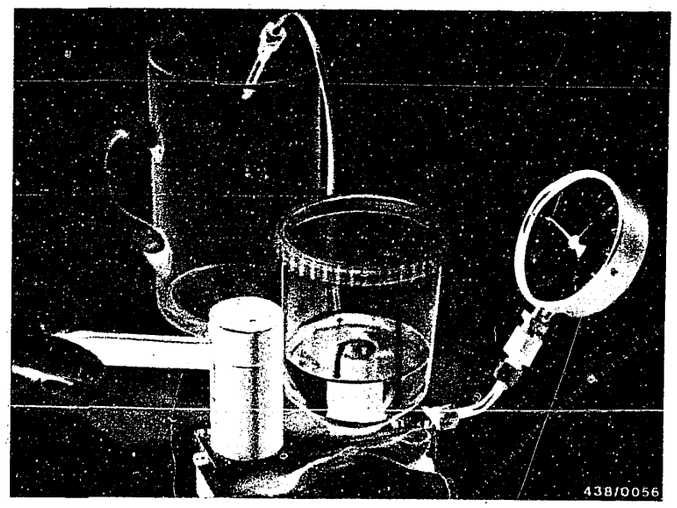
Bosch order designation VS 14 942-CH (previously part number 5 973 340 650). The Bosch test gasoline can be obtained in 5-litre cans from the following supplier:

Oskar Gnamm & Co.
D-7531 Kämpfelbach-Bilfingen

Caution:!

For safety reasons, never use normal gasoline or similar easily inflammable and combustible liquids. Even with calibrating fluid, be sure to observe the local official regulations.

16.2 Connecting the injection valve to the tester



Connect the injection valve to the valve tester and bleed the delivery line by operating the lever several times with the union nut open. Then tighten the union nut (top picture).

16.3 Checking for dirt

Move the hand lever slowly (about 2 seconds per stroke) back and forth with the stopcock on the pressure gauge open. If the pressure does not build up to 1...1.5 bar gauge pressure, the injection valve has a bad leak (caused, for example, by dirt stuck in it). You can try to flush the injection valve clear by moving the lever back and forth several times strongly. If this attempt is successful, continue the test. If it is not possible to flush the valve clear, replace it.

16.4 Testing the opening pressure

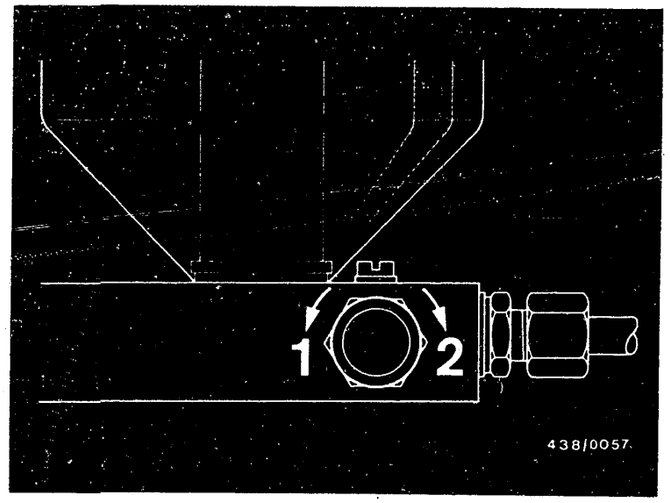
Injection valve	Test specifications - opening pressure
0 437 502 010	3.0 ... 4.1 bar gauge pressure

With the stopcock closed, flush and bleed the valve with several movements of the lever. Open the stopcock and check the opening pressure whilst moving the lever slowly (approx. 2 secs. per stroke).

If the opening pressure is not within the tolerance, change the injection valves. Individual injection valves within a set can also be changed.

16.5 Leakage test

Open the stopcock and increase the pressure slowly to 0.5 bar below the previously calculated pressure and maintain at this pressure.
No drop must fall from the valve for 15 s.



1 = Open 2 = Shut

16.6 Chatter test, evaluation of spray

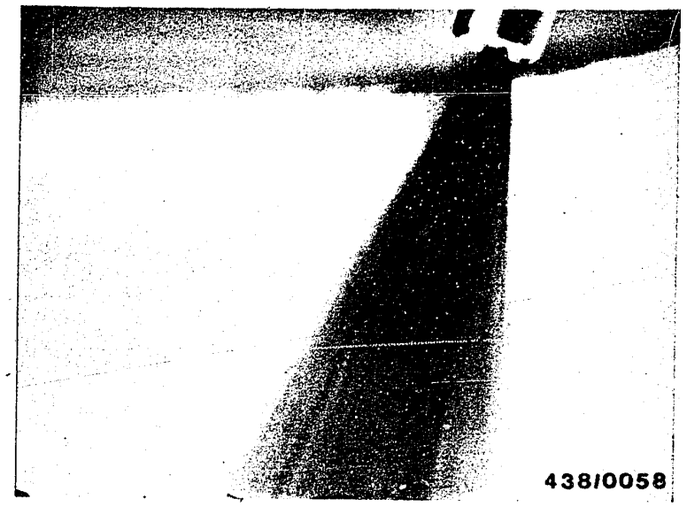
Move the lever back and forth at about 1 stroke per second. As this is done, the valve must chatter. No drops of fuel must form at the mouth of the valve. The valve must not produce a "cord spray". Formation of a single-sided, atomized spray within an overall spray angle of about 35° is permissible (see example given in illustrations).

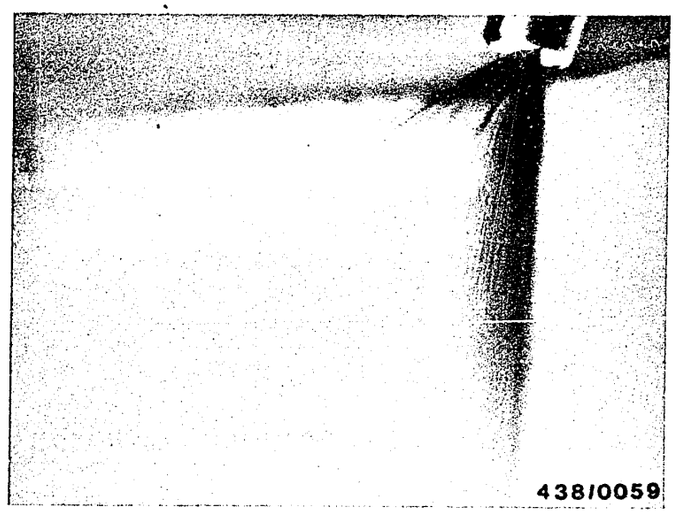
Illustration shows good spray formation.

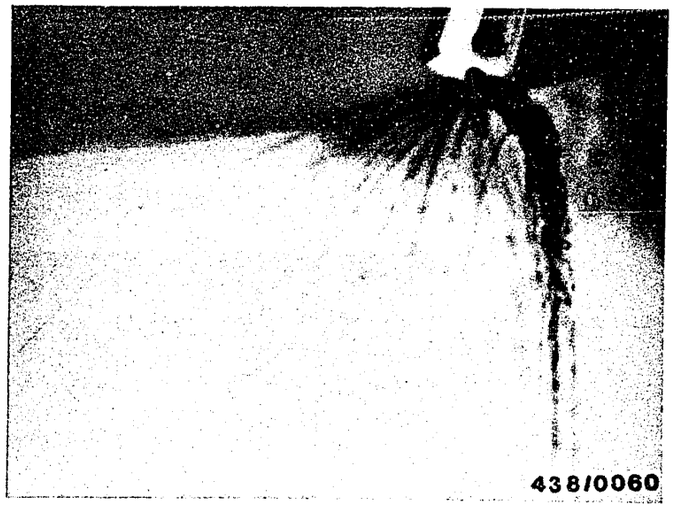
Bottom picture shows formation of drops.

Illustration shows single-sided but nevertheless good spray formation.

Poor spray formation; replace injection valves.

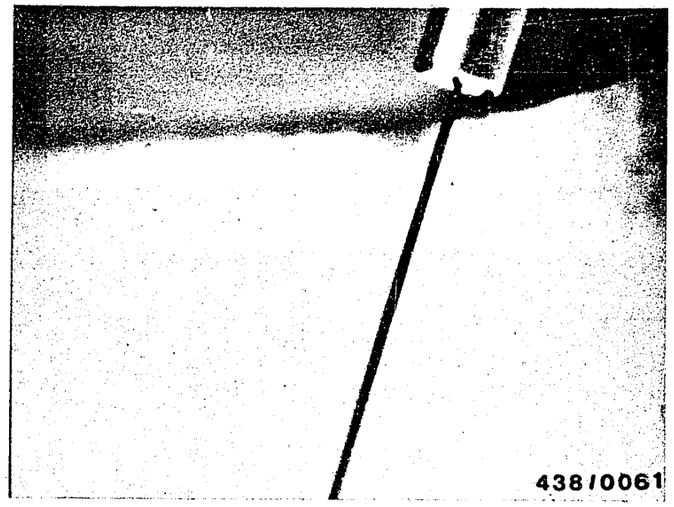

438/0058


438/0059


438/0060

Top picture shows cord spray.

Poor spray formation; replace injection valves.

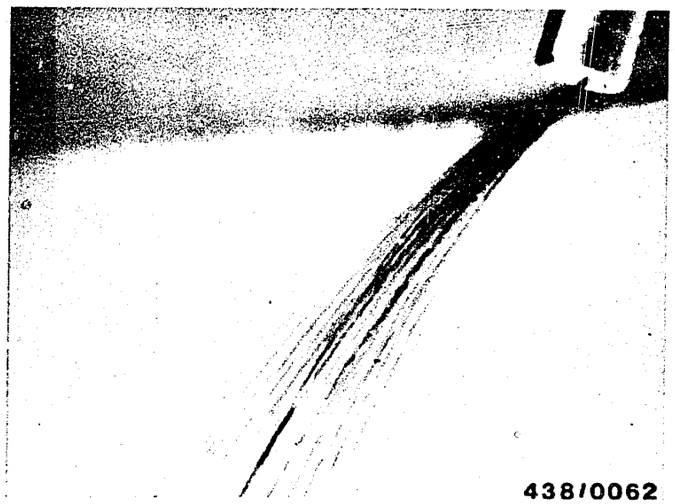


Bottom picture shows spray in strands.

Poor spray formation; replace injection valves.

If defective injection valves have been replaced, it is necessary finally to adjust the idle speed with the engine at normal operating temperature.

Idle-speed adjustment is described on Coordinates K 1.



17. COMPARATIVE MEASUREMENT OF FUEL DELIVERY OF FUEL DISTRIBUTOR OUTLETS

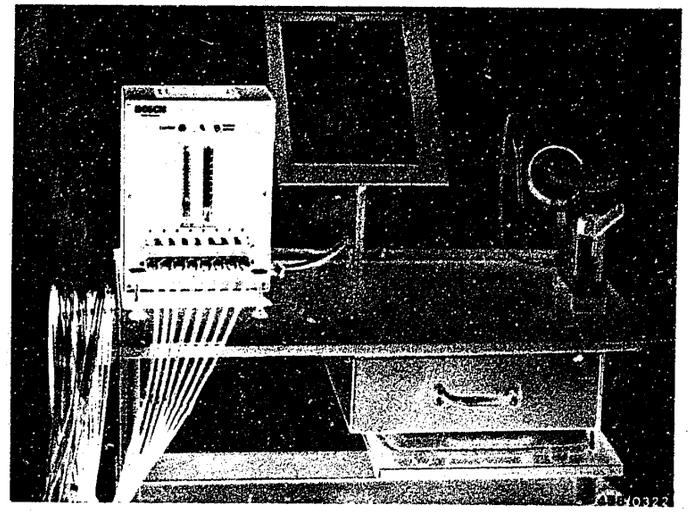
This test is carried out using the tester for delivered quantity comparison KDJE-P 200 (previously KDJE 7451).

17.1 Application

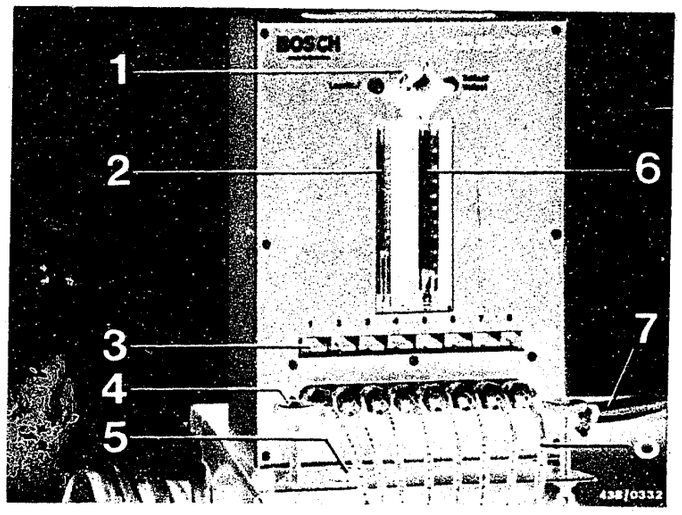
By means of comparative measurements, the differences in the amounts of fuel delivered from the individual outlets on the fuel distributor are determined. The tester is designed so that the test can be made on the vehicle without having to remove the fuel distributor.
Since the test is made with the original injection valves, the operator can recognize at the same time whether delivered-quantity scatter, if it occurs, is caused by the fuel distributor or by the injection valves.

17.2 Construction

The tester is designed for all engines up to and including 8-cylinder designs.



1 = Three-way changeover cock
2 = Small test tube
3 = Buttons for 8-way valve
4 = Adjusting screw for setting up
5 = Spirit level
6 = Large test tube
7 = Fuel return line
8 = Polyamide hoses (test lines)



Basically, the tester consists of a steel housing containing 2 rotameter tubes with measuring ranges of 2...15 cm³ and 10...180 cm³, an 8-way valve for key operation (Item 3) and a 3-way stopcock (Item 1).

The small rotameter tube (Item 2) is used for the idle measurement while the large tube (Item 6) is used to measure the fuel delivery at part- and full-load. The particular rotameter tube to be used is connected by means of the 3-way stopcock. Using the 8-way valve, the fuel delivery of each cylinder is tested one after the other.

Attached to the tester are 8 hoses (Item 8), each terminated with an automatic connector. When the injection valves are withdrawn from their sockets on the engine they are attached to these connectors. Each automatic connectors is fitted with a push valve so that no fuel can escape from connectors that are not in use (when 4- or 6-cylinder systems are tested).

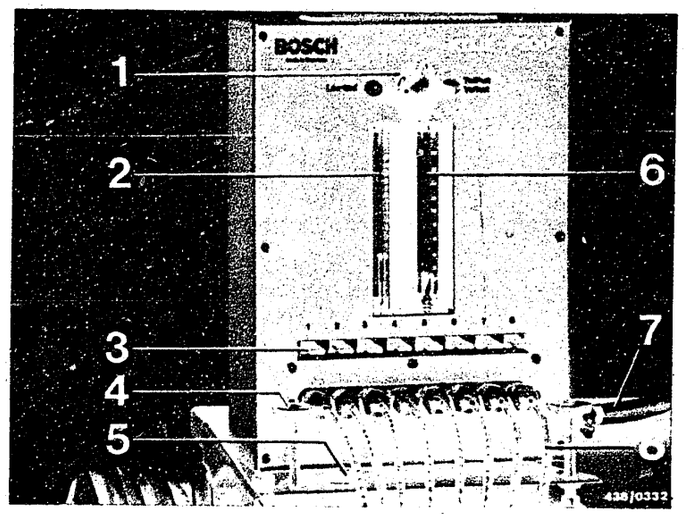
The fuel is returned to the fuel tank through a hose (Item 7) about 5 m long.

The entire test is made with a closed circuit, i.e. no fuel escapes.

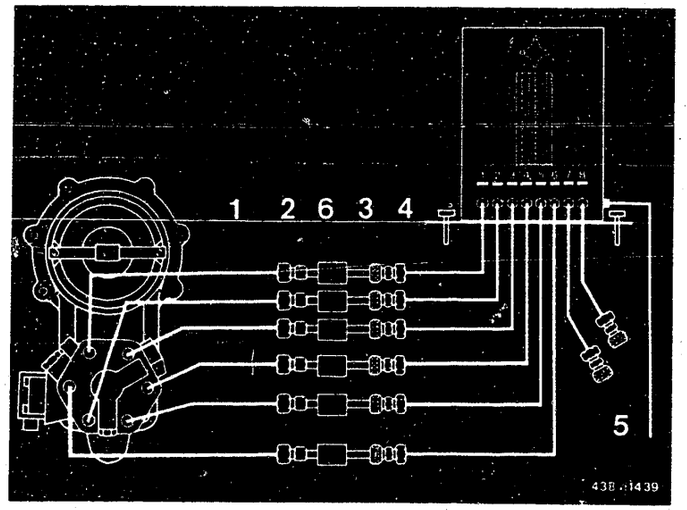
17.3 Setting up and connecting the tester for delivered quantity comparison

Set the tester up securely next to the vehicle (e.g. on tester trolley KDJE-W 100) and align according to the spirit level (bubble level on base of tester).

To prevent the stiff fuel-injection tubing from becoming kinked, the tester for delivered quantity comparison is used with an adapter cable KDJE-P 200/25.



1 = Adapter leads from the cable set KDJE-P 200 / 25
2 = Fuel-injection valves
3 = Snap-on couplers
4 = Equipment lines
5 = Return line to the fuel tank filler neck



The injection valves should be removed for the test When loosening the fuel lines, apply counter force at the fixed hexagon of the injection valves. Also unscrew the fuel-injection lines at the fuel distributor. The steel fuel-injection lines must not be kinked.

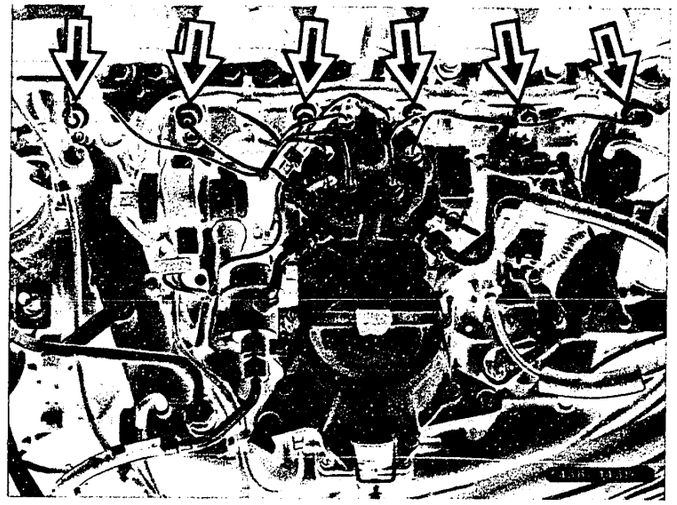
When refitting the injection valves, it is best to replace the O-rings on the valve stem (Mercedes-Benz service part)in order to prevent leaks and thus the entry of unmetered air.

Connect the fuel-injection valves to the adapter cables.

Clean the injection valves with a cloth and plug in the correct order into the automatic connectors of the first six tester hoses.

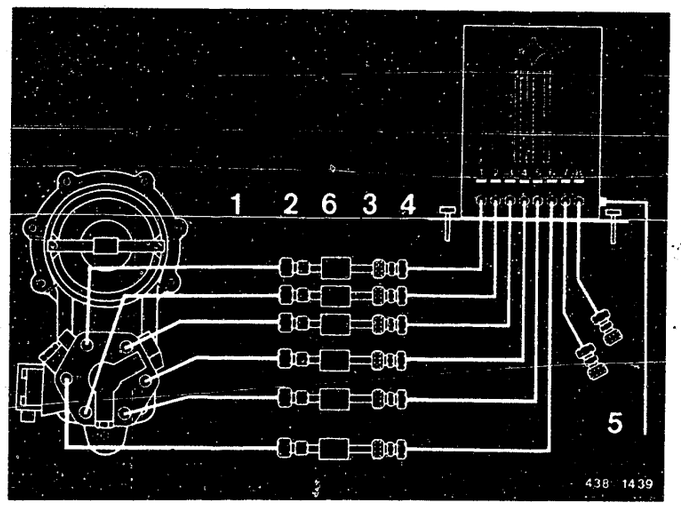
Note:

Plug in the injection valves firmly as far as they will go and tighten the knurled nuts securely so that the non-return valves of the automatic connectors are completely open. Introduce the return hose of the tester into the fuel tank filler neck.



1 = Adapter leads from the cable set KDJE-P 200 / 25

2 = Fuel-injection valves
3 = Snap-on couplers
4 = Equipment lines
5 = Return line to the fuel tank filler neck



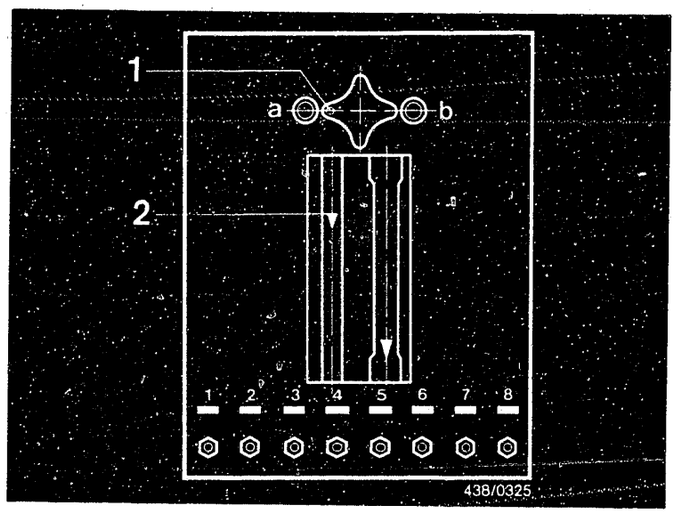
17.4 Bleeding the tester for delivered quantity comparison

Remove the air filter so that the air-flow sensor plate is accessible. Disconnect the electric plug from the auxiliary-air device.
Switch on the electric fuel pump by bridging the electrical safety circuit.
Push the air-flow sensor plate of the auxiliary-air device through as far as it will go.
Press the buttons of the 8-way valve one after the other. In doing this switch over the 3-way changeover cock several times until both rotameter tubes have been bled.
Bring the air-flow sensor plate into the rest position again.

17.5 Testing

The flow comparison measurement is made in the idle, part-load and full-load ranges. The small rotameter tube is to be used for the idle measurement (white dot to the left on control knob); part-load and full-load measurements are made using the large rotameter tube (white dot to the right).

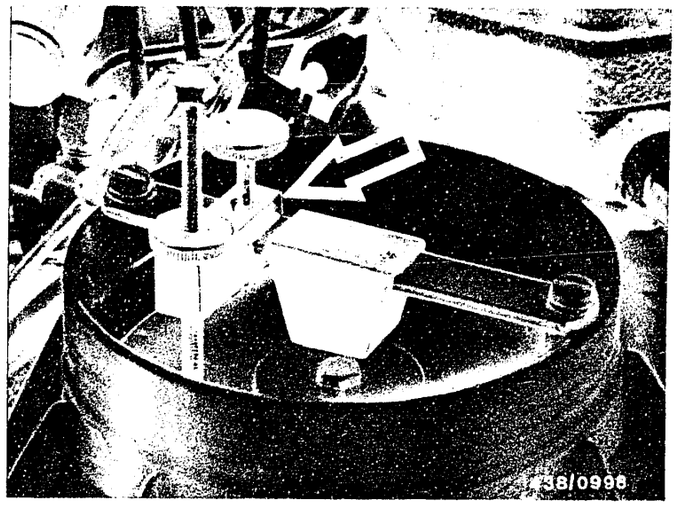
The delivered quantities indicated on the rotameter tubes are read off at the top edge of the conical float (Item 2). On testers with a ball float the uppermost point of the ball is used for reading off. With each measurement be sure to wait until the float has reached its final position. This may take 20 ... 30 seconds in the case of small deliveries.



1 = White dot
2 = Measuring line
a = Idle
b = Part load/full load

The exact setting and locating of the position of the air-flow sensor plate for the various load ranges is done using the setting device KDJE 7456.

With the adjusting screw initially screwed all the way out, the setting device is clamped onto the stop bracket of the air funnel (arrow).
Adjust the position of the air-flow sensor plate using the adjusting screw.

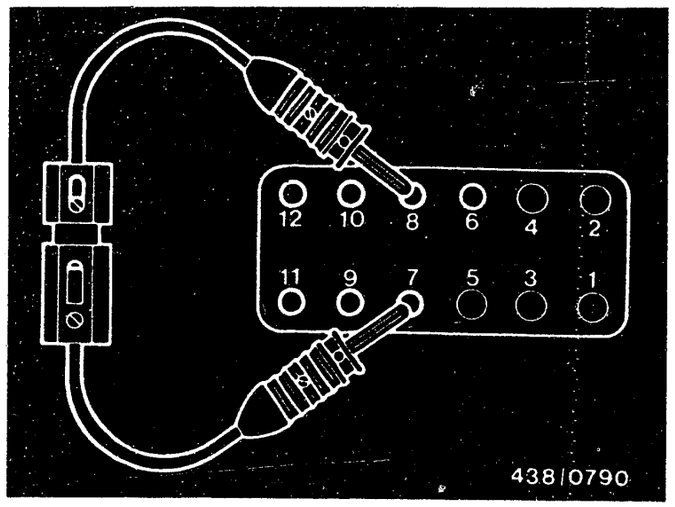


Test procedure

Switch on the electric fuel pump by bridging the safety circuit.
Pull off the cable plug from the electro-hydraulic pressure actuator.

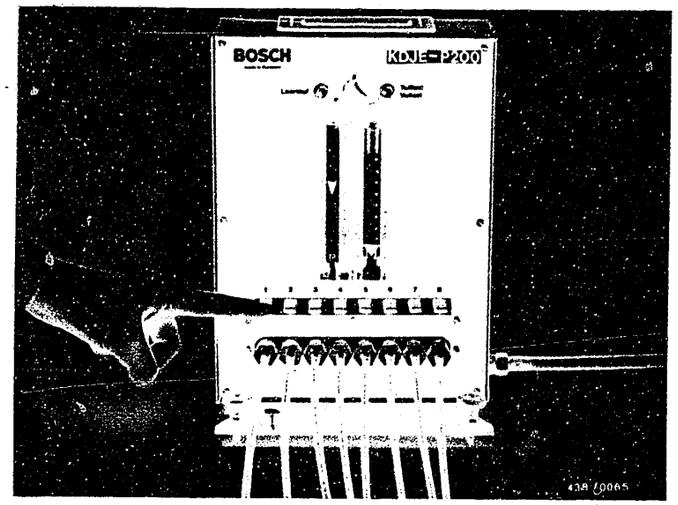
In the following section, fixed limits are given as the maximum permissible delivered-quantity differences for the individual load ranges.

The "setting point" value always refers to the fuel-distributor outlet with the least fuel delivery, i.e. first of all find out which outlet has the least fuel delivery.



Test specifications

Load range	Set point	Max. permissible fuel delivery
Idle	6.0 cm^3/min	6.6 cm^3/min
Part load	40.0 cm^3/min	42.5 cm^3/min
Full load	100.0 cm^3/min	109.0 cm^3/min
Full-load with max. deflection of air-flow sensor flap. - Min. delivery of all outlets	140.0 cm^3/min	---------



Press the key for outlet 1. Pivot the air-flow sensor plate until the corresponding rotameter tube approximately indicates the "set point" value. Fix the air-flow sensor plate in this position.

Test the remaining outlets in order to determine which outlet has the lowest fuel delivery.

Press the key for this outlet again, and set the delivery precisely to the "set point" by correcting the position of the air-flow sensor plate. Then fix the air-flow sensor plate in this position again.

Press the remaining keys one after the other, and determine the maximum fuel delivery of each outlet. A deviation in fuel delivery can only be above the "set point".

If, in testing, a too large difference is ascertained in one of the three load ranges, the test should for safety's sake be repeated.

If the result is confirmed, you should check whether the fault lies in the fuel distributor or in the injection valves.

To do this interchange the injection valves with the greatest and smallest difference.

If the result is still the same, the fault is in the fuel distributor. If the fault follows the interchanged injection valves, it lies in the injection valves.

Change defective fuel distributor and/or replace defective injection valves.

17.6 Concluding work

Check the O-rings on the valve stem for damage. Replace damaged seals (Mercedes-Benz service part).
Fit the injection valves again and reconnect all fuel lines. Make sure that the fuel lines are correctly routed. Connect the electric safety circuit again (fit the relay). Reconnect the plug on the electrohydraulic pressure setting device. Check by means of a test run that there are no leaks in the connections.
Then check the idle adjustment and correct if necessary. The idle adjustment is described on coordinates K 1.

18. TESTING THE CORRECTION FUNCTIONS WITH UNIVERSAL TEST ADAPTER ETT 018.01 0 684 101 801, KE-JETRONIC TEST LEAD 1 684 463 169 AND MULTIMETER

18.1 Notes on the following trouble-shooting program

The program is divided into three rows of boxes: the boxes in the left-hand row represent the most convenient sequence of the test steps. Each box also contains all the necessary information on the operation of the universal test adapter and measuring equipment, test conditions, test procedure and test specifications.

The centre row contains the necessary information on how to find and eliminate the fault for each test step.

The right-hand row provides additional information in the way of pictures and sketches, as required.

The sequence of the test steps represents the most convenient procedure. Always go through the entire program since the individual test steps follow on from each other. Only branch to the centre row of boxes if, when performing a test step, the test specifications or other requirements are not met.

Note:
In the following test steps, a white border in the "Operation" column shows which operation has to be changed in comparison with the preceding test step.

18.2 Connecting the Universal Test Adapter

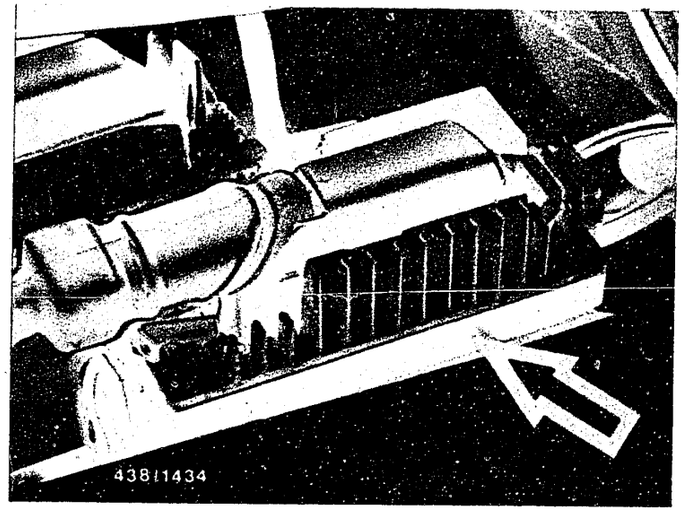
Slide KE control unit (top picture - arrow) upward in its mounting and remove.

Remove mutliple plug from control unit (push back detent and first of all hinge the plug up on the side of the detent). Connect the plug to the terminal strip of the test lead of the universal test adapter.

The multiple plug of the test lead is intended for connection to the control unit. However, connection must only be made for certain tests in the following test chart. Note the corresponding information in each test step.

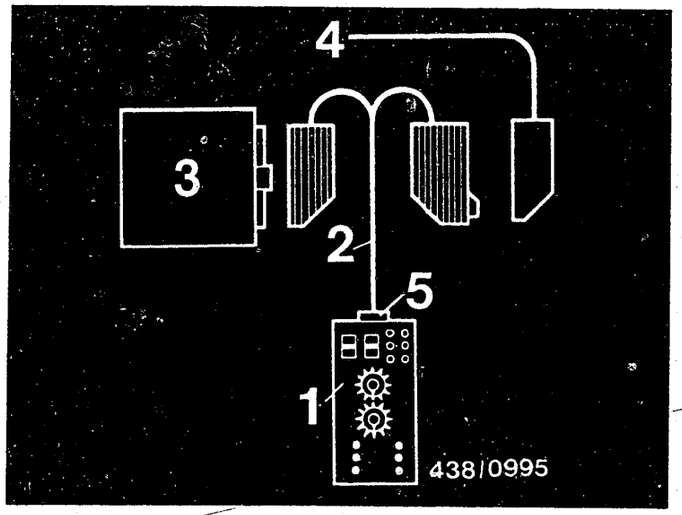
Important note:
Make sure that the ignition is off whenever connecting or disconnecting from the control unit.

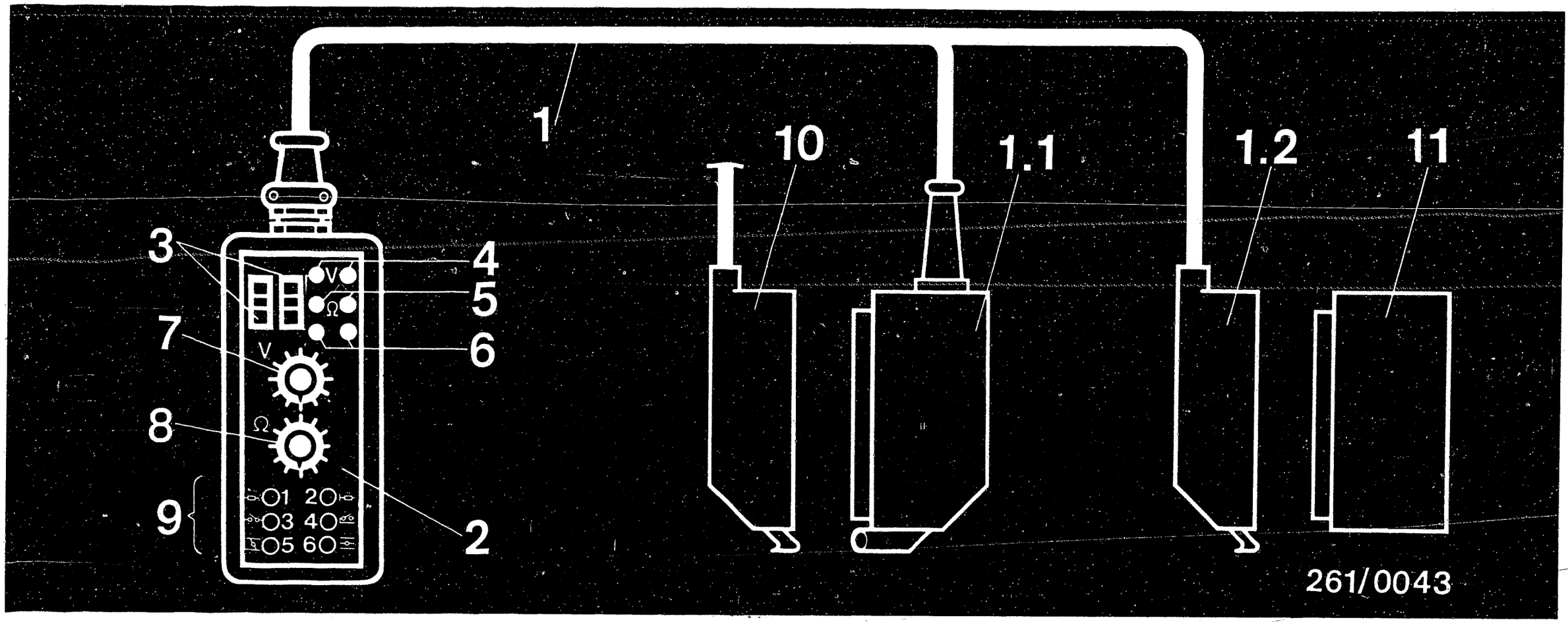
Connect multimeter to the appropriate test sockets on the universal test adapter (V, Ω, 1 - 2 for current measurements) in accordance with manufacturer's instructions. Multimeter: e.g. BOSCH-Motortester MOT 300/400 with Shunt 1 684 503 098, or commercially available e.g. Fluke-Multimeter 75.



Arrow = KE control unit

1 = Universal test adapter
2 = System adapter lead
3 = Control unit
4 = System wiring harness
5 = Pin terminal





18.3 Construction and use of universal test adapter:

1 = Test lead for KE-Jetronic 1 684 463 135
1.1 = Connection to wiring harness
1.2 = Connection to control unit
2 = Universal test adapter ETT 018.01 - 0 684 101 801
3 = Test wells for motortester (not used for KE-Jetronic)
4 = Test sockets for voltage measurement
5 = Test sockets for resistance measurement
6 = Test sockets for current measurement
7 = Program switch "V"
8 = Program switch "Ω"
9 = Button panel for simulating operating conditions
Button 1 = Simulation of engine "cold" (-20°C)
Button 2 = Simulation of engine "warm" (approx. +80°C)
Button 3 = Not occupied for KE-Jetronic
Button 4 = Simulation of "starting motor operation"
Button 5 = Simulation of throttle-valve switch "idle"
Button 6 = Simulation of throttle-valve switch "full load"
10 = Multiple plug of KE-Jetronic wiring harness
11 = Control unit

TEST STEP 1

Component/Function:

Pressure actuator internal resistance (R_i)

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	4
Test button	-

Test condition:
Switch off ignition; disconnect plug from control unit.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:

Test specification (reading):
20 ... 30 Ω

Reading within test-specification tolerance?

No →

Yes ↓

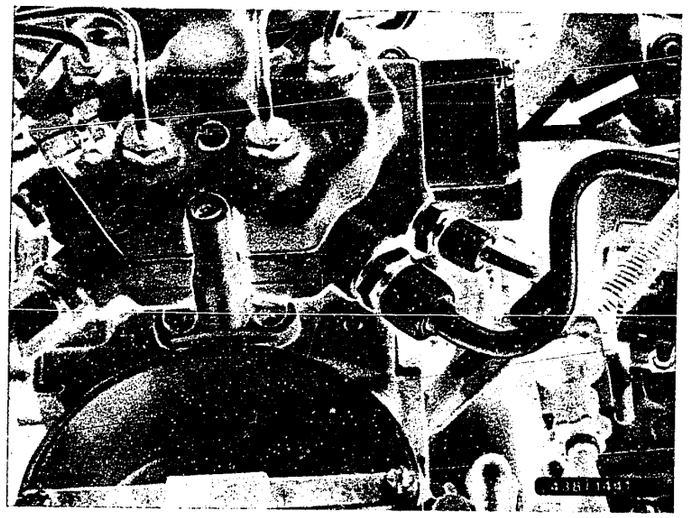
Continued on next picture page

Trouble-shooting:

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead. Disconnect plug from electro-hydraulic pressure actuator.

Perform the following checks:

- Using ohmmeter, check leads 10 and 12 from control unit plug to pressure actuator plug for continuity.
  Specification: approx. 0 Ω .
  Eliminate open circuit, if applicable.
- Direct resistance measurement at pressure actuator (arrow).
  Specification: 15 ... 20 Ω .
  If not, replace pressure actuator.
- Caution: Be sure to use new seal rings and only the two original fastening screws (non-magnetic steel). These parts are grouped together with the pressure actuator as a parts set.



Arrow = Pressure actuator

TEST STEP 2

Component/Function:
Resistance of engine temperature sensor (NTC II)

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	5
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 5000 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:

Test specification (reading):
Engine temperature:

+15 ... +30°C:	1300 ... 3600 Ω
approx. +80°C:	250 ... 390 Ω

Readings within test-specification tolerance?

No →

Trouble-shooting:

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.
Disconnect plugs (both) from temperature sensor.

Perform the following checks:

- Using ohmmeter, check lead 21 from control unit plug to temperature sensor plug for continuity.
  Specification: approx. 0 Ω .
  Caution: Double NTC!
  Find out which of the two leads is correct.
  Eliminate open circuit, if applicable.
- Direct resistance measurement at NTC to housing ground. The values must be obtained at both NTC elements.

Replace defective NTC.

Yes ↓

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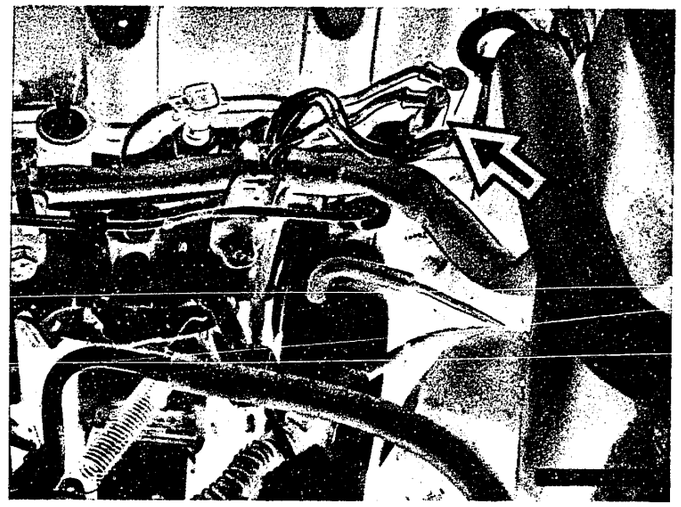

Arrow = Engine temperature sensor (NTC II)

TEST STEP 3

Component/Function:
Intake air temperature sensor (NTC I)
(If applicable; introduced as of approx. mid-1985)

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	6
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 5000 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:

Test specification (reading):
Air temperature in region of temperature sensor:
+15°C ... +30°C = 1300 ... 3600 Ω

Reading within test-specification tolerance?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.
Disconnect plug from intake air temperature sensor.

- Using ohmmeter, check lead term. 11 from control unit plug to temperature sensor for continuity. Specification: approx. 0 Ω .

  Eliminate open circuit/contact resistance, if applicable.

  If O.K., direct resistance measurement at temperature sensor to engine ground.

  Replace defective temperature sensor I.

Yes ↓

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TEST STEP 4

Component/Function:
Idle throttle valve switch

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	9
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:
Actuate throttle valve

Test specification (reading):
Throttle valve closed:
0 ... 10 Ω
Throttle valve open: ∞Ω

Reading (function) O.K.?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.
Disconnect triple throttle-valve switch plug (bottom picture, arrow).
Perform the following checks:

- Using ohmmeter, check operation of throttle-valve switch directly at triple plug:
  Connection between pins 1 and 2.
  Throttle valve closed: 0 Ω.
  Throttle valve open: min. 1000 Ω.
  If incorrect, adjust throttle-valve switch, or replace and adjust. Adjust by turning so that the contact is reliably closed at idle and opens immediately when throttle is opened.
- Check connection between pin 2 and engine ground.
  Specification: 0 Ω.
- Check lead pin 1 to terminal 13 on control unit plug for continuity.
  Specification: 0 Ω.
  Eliminate open circuit, if applicable.

Yes ↓

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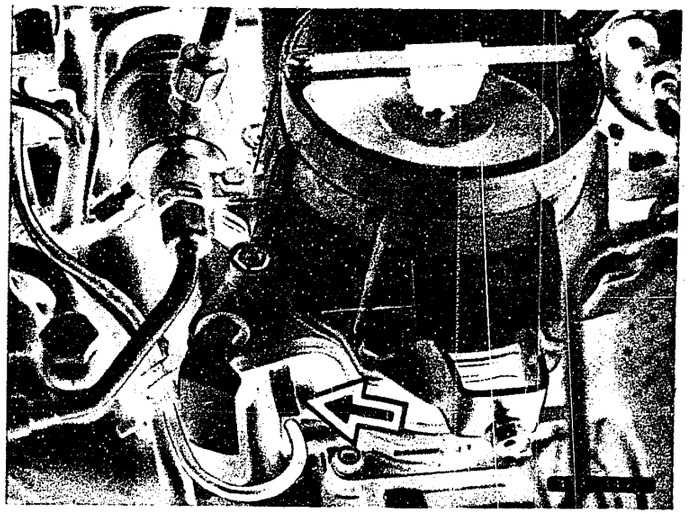
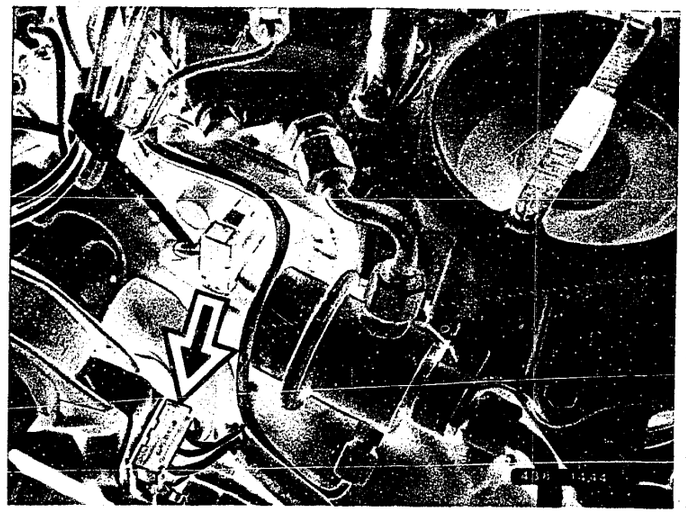


Arrow = Throttle-valve switch



Arrow = Throttle-valve switch plug

TEST STEP 5

Component/Function:
Full-load throttle-valve switch

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	10
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:
Actuate throttle valve

Test specification (reading):
Throttle valve closed: ∞Ω
Throttle valve wide open:
0 ... 10 Ω

Reading (function) O.K.?

No →

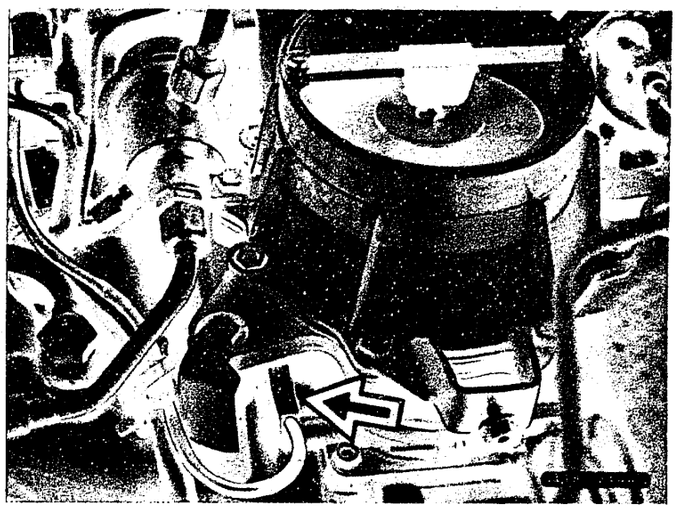
Yes ↓

Continued on next picture page

Trouble-shooting

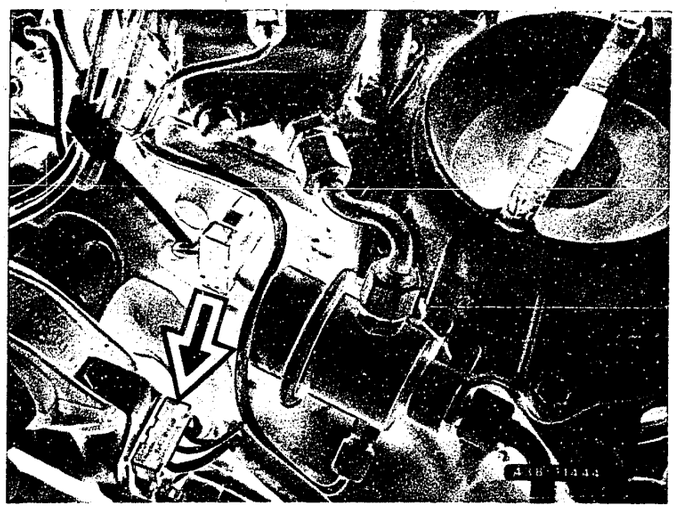
If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.
Disconnect triple throttle-valve switch plug (bottom picture, arrow).
Perform the following checks:

- Using ohmmeter, check operation of throttle-valve switch directly at triple plug: connection between pins 2 and 3. Throttle valve closed: ∞Ω
  Throttle valve wide open: 0 Ω.
  If incorrect, replace throttle-valve switch and adjust. Adjust by turning so that the idle contact (measurement between pins 1 and 2) is reliably closed at idle and opens immediately when throttle is opened.
- Check leads from pin 2 to engine ground and pin 3 to terminal 5 on control unit plug for continuity.
  Specification: approx. 0 Ω.
  Eliminate open circuit, if applicable.



Arrow = Throttle-valve switch

Arrow = Throttle-valve switch plug



TEST STEP 6

Component/Function:
Throttle-valve switch (microswitch) on linkage.

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	11
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:
Actuate throttle valve

Test specification (reading):
Throttle valve closed:
0 ... 10 Ω
Throttle-valve linkage.
Free travel covered, but throttle valve not moved: ∞Ω

Reading (function) O.K.?

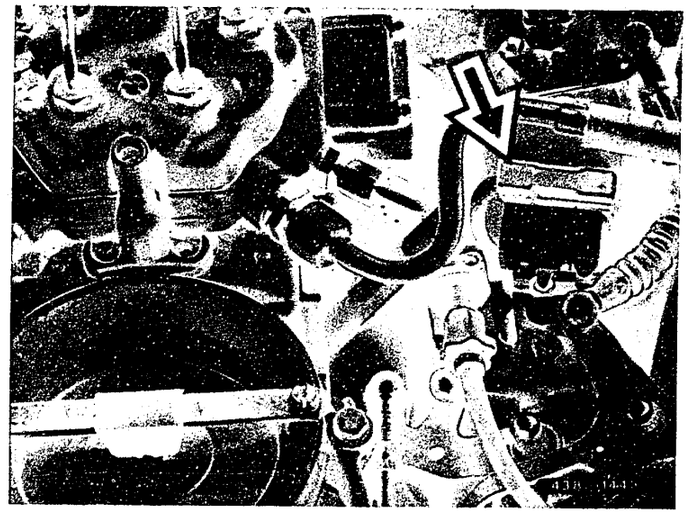
No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.
Disconnect plug from microswitch.

Perform the following checks:

- Using ohmmeter, check the two leads of the double plug on microswitch, one to engine ground, one to terminal 24 on control unit plug, for continuity.
  Specification: 0 Ω .
  Eliminate open circuit, if applicable.
- Functional check with ohmmeter directly at microswitch:
  Throttle valve closed: 0 ... 10 Ω
  Throttle-valve linkage free travel covered, but throttle valve not moved: ∞Ω
  If incorrect, check adjustment or replace microswitch and adjust. When adjusting, note that the switching point must be within the free travel of the linkage.



Arrow = Microswitch

↓ Yes

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TEST STEP 7

Component/Function:
Ground connection of output stage, control unit term. 20

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	12
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measurement equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:

Test specifications (reading)
0 ... 10 Ω

Reading within test-specification tolerance?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Using ohmmeter, check lead 20 from control unit plug to battery ground for continuity.
Specification: approx. 0 Ω

Eliminate open circuit or contact resistance, if applicable.

Yes ↓

Continued on next picture page

TEST STEP 8

Component/Function:
Ground connection of control unit, term. 7

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	13
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:

Test specification (reading):
0 ... 10 Ω

Reading within test-specification tolerance?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Using ohmmeter, check lead 7 from control unit plug to engine ground for continuity.
Specification: approx. 0 Ω

Eliminate open circuit or contact resistance, if applicable.

Yes ↓

Continued on next picture page

TEST STEP 9

Component/Function:
Mixture map encoding plug

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	14
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measurement equipment:
Motortester or multimeter

Measuring range:
0 ... 10k Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:
Swap over terminals of encoding plug

Test specification (reading)
Encoding plug position
1 = approx. 0 Ω
2 = 460 ... 510 Ω
3 = 0.91 ... 1.0 kΩ
4 = 1.54 ... 1.7 kΩ
5 = 2.48 ... 2.6 kΩ
6 = 4.2 ... 4.65 kΩ
7 = 8.2 ... 9.1 kΩ

Readings within test-specification tolerance?

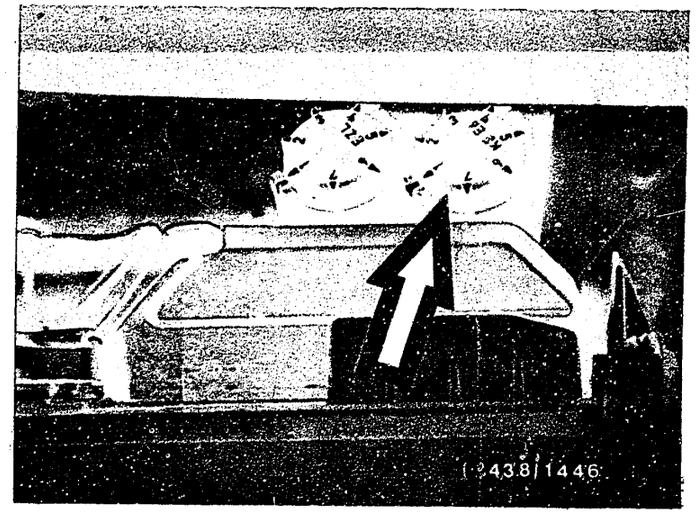
No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Perform the following checks:

- If reading in all positions too high or $^{\infty}\Omega$:
  Using ohmmeter, check for open circuit/contact resistance in leads from encoding plug (arrow) to engine ground and term. 22 on control unit plug.
  Eliminate open circuit/contact resistance, if applicable.
- If only individual readings not within tolerance:
  Replace encoding plug (arrow).



Arrow = Encoding plug

↓ Yes

Continued on next picture page

TEST STEP 10

Component/Function:
Transmission switch (automatic transmission)

Operation:	Position:
Progr. switch "V"	→
Progr. switch "Ω"	15
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 50 Ω

Connection on adapter:
Blue test sockets

Operation in vehicle:
Actuation of selector lever

Test specification (reading):
Selector lever position P,N: 0 ... 10 Ω
Drive mode selected: ∞Ω

Reading within test-specification tolerance?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Perform the following checks:

- Using ohmmeter, check for open circuit in lead term. 16 from control unit plug to transmission switch (through engine cable set plug connector, term. 10; the plug connector is under the instrument panel, behind the instrument cluster).
  Specification: approx. 0 Ω .
  Eliminate open circuit/contact resistance, if applicable.

- The transmission switch itself is functioning correctly if the operation of the starting motor is O.K., i.e. starting in positions P, N; no starting with drive mode selected.

Yes ↓

Continued on next picture page

TEST STEP 11

Component/Function:
TD signal (ignition)

Operation:	Position:
Progr. switch "V"	5
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Ignition on, operate starting motor (engine can start).

Test specification (reading):
Voltage reading (value undefined)

Voltage reading?

No →

Trouble-shooting

If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

- Using ohmmeter, check for open circuit in lead term. 25 from control unit plug to ignition trigger box term. TD.
  Routing of lead in engines with air conditioner:
  Term. 25 - electric fuel pump relay, term. TD (10) - compressor cutoff relay term. 2 (TD) - diagnostic socket, term. 1 - ignition trigger box, term. TD (2).

  Routing of lead in engines without air conditioner:
  Term. 25 - electric fuel pump relay, term. TD (10) - diagnostic socket, term. 1 - ignition trigger box, term. TD.

  Eliminate open circuit, if applicable.

Yes ↓

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TEST STEP 12

Component/Function:
Control unit power supply, term. 1

Operation:	Position:
Progr. switch "V"	6
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.

Test specification (reading):
8 ... 15 V

Reading within test-specification tolerance?

No

Yes

Continued on next picture page

Trouble-shooting:
If necessary, use electrical circuit diagram.

Possible cause of trouble:
- Overvoltage protection relay/ relay fuse defective.
- Open circuit in lead from term. 1 on control unit plug to term. 87 on overvoltage protection relay.
- Open circuit in one of the other energization leads to the over-voltage protection relay:

+ Term. 30 - engine cable connector, term. 30
+ Term. 15 - electric fuel pump relay - engine cable set plug connector, term. 1 (plug connector is under instrument panel, behind instrument cluster).
+ Term. 31 - battery ground.

Check the leads with ohmmeter with battery disconnected.
Specification: approx. 0 Ω
Eliminate open circuits/contact resistances, if applicable. If all leads O.K.: replace over-voltage protection relay.

TEST STEP 13

Component/Function:
Idle actuator power supply and continuity of idle actuator winding.

Operation:	Position:
Progr. switch "V"	7
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
8 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.

Test specification (reading):
8 ... 15 V

Reading within test-specification tolerance?

No →

Trouble-shooting
If necessary, use electrical circuit diagram.

Possible cause of trouble:
- Open circuit in idle actuator winding. Check with ohmmeter (value approx. 10 Ω). Replace defective idle actuator.

- Open circuit in one of the following leads:
+ Overvoltage protection term. 87 - idle actuator term. 2
+ Idle actuator term. 1 - control unit plug term. 3.

Check the leads with ohmmeter with battery disconnected. Specification: approx. 0 Ω .
Eliminate open circuit/contact resistance, if applicable.

Yes ↓

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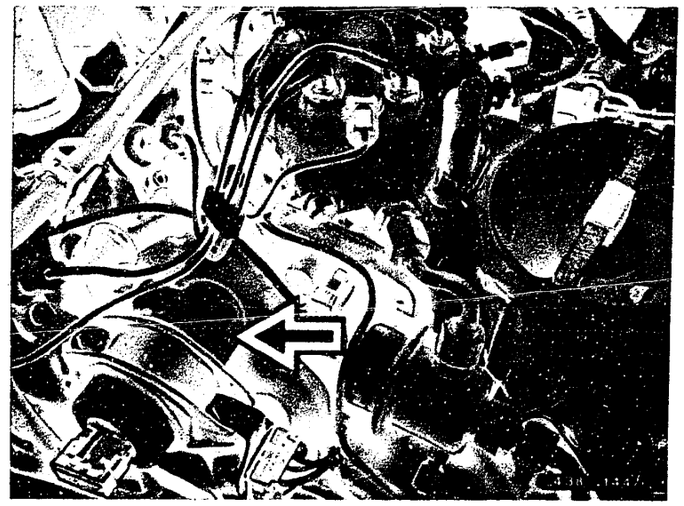


Arrow = Idle actuator

TEST STEP 14

Component/Function:
Signal from cruise control to control unit, term. 6

Operation:	Position:
Progr. switch "V"	8
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.
Switch on cruise control.

Test specification (reading):
8 ... 15 V

Reading within test-specification tolerance?

No

Trouble-shooting
If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Using ohmmeter, check for open circuit in lead term. 6 from control unit plug to cruise control plug connector.

Specification: approx. 0 Ω

Eliminate open circuit/contact resistance, if applicable.

No

Yes

Continued on next picture page

TEST STEP 15

Component/Function:
Air conditioner switch-on signal to control unit, term. 19.

Operation:	Position:
Progr. switch "V"	9
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Disconnect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Start engine - idling. Switch on air conditioner switch. Switch on fan. Set temperature controller to minimum temperature

Test specification (reading):
8 ... 15 V

Reading within test-specification tolerance?

No →

Trouble-shooting
If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead.

Using ohmmeter, check for open circuit in lead term. 19 from control unit plug to air conditioner control unit (compressor cutoff) term. 87 Z.

Specification: approx. 0 Ω

Eliminate open circuit/contact resistance, if applicable.

↓ Yes

Continued on next picture page

TEST STEP 16

Component/Function:
Power supply for potentiometer on air-flow sensor (control unit output, term. 18).

Operation:	Position:
Progr. switch "V"	10
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Connect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.

Test specification (reading):
4.35 ... 5.35 V

Reading within test-specification tolerance?

No → **Trouble-shooting:**

Incorrect reading or no reading: control unit defective.

Replace control unit.

Yes ↓

Continued on next picture page

TEST STEP 17

Component/Function:
Signal from potentiometer on air-flow sensor

Operation:	Position:
Progr. switch "V"	11
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Connect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.
Deflect sensor plate by hand.

Test specification (reading):
Sensor plate in rest position: 0 V
Slowly deflect sensor plate, resulting in continuous voltage rise up to: max. 5.35 V

Reading within test-specification tolerance?

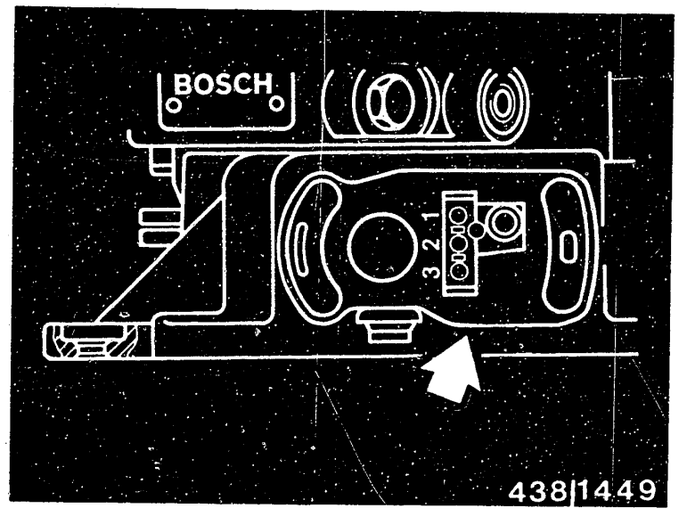
No →

Trouble-shooting:
If necessary, use electrical circuit diagram.
Disconnect control unit plug from KE test lead. Disconnect plug from air-flow sensor potentiometer.

Using ohmmeter, check the following leads for open circuit/contact resistance (specification: approx. 0 Ω):

- Control unit plug, term. 18 (+), 17 (signal) to potentiometer plug, term. 3 and 2.
- Potentiometer plug, term. 1 to engine ground.
  Eliminate open circuit/contact resistance, if applicable.
- If O.K., check potentiometer for open circuit directly at the pins:
- Between term. 1 (-) and 3 (+): approx. 4 kΩ.
  Between term. 3 and 2 (signal): variable.

Note: Assessment of characteristic by resistance measurement not possible.
If potentiometer defective: replace complete air-flow sensor.



Arrow = Potentiometer on air-flow sensor

Yes ↓

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TEST STEP 18

Component/Function:
Temperature signal from control unit term. 9 to electric fuel pump/cold-start control relay.

Operation:	Position:
Progr. switch "V"	13
Progr. switch "Ω"	-
Test button	1

Test condition:
Ignition off. Connect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 3 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Switch on ignition.

Test specification (reading):
While TA 1 pressed:
1.5 ... 1.9 V

Reading within test-specification tolerance?

No

Trouble-shooting:

Incorrect reading or no reading:
control unit defective.

Replace control unit.

Yes

Continued on next picture page

TEST STEP 19

Component/Function:
Consumption signal from control unit, term. 4

Operation:	Position:
Progr. switch "V"	14
Progr. switch "Ω"	-
Test button	-

Test condition:
Ignition off. Connect control unit plug.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 15 V

Connection on adapter:
Red socket (+) and black socket (-)

Operation in vehicle:
Start engine - idling.

Test specification (reading):
Idle: voltage reading (undefined)
Change in engine speed: change in voltage.

Function O.K.?

No

Trouble-shooting:

No reading:
Control unit defective.
Replace control unit.

Yes

Continued on next picture page

TEST STEP 20

Component/Function:
Control unit function
"static current"

Operation:

	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	-

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Switch on ignition.

Test specification (reading):
9 ... 11 mA

Reading within test-specification tolerance?

No →

Trouble-shooting:

No reading or reading incorrect:

Control unit defective.

Replace control unit.

Yes ↓

Continued on next picture page

TEST STEP 21

Component/Function:
Control unit function
"warm-up enrichment + 20°C"

Operation:	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	1

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Start engine, warm up, run at idle speed.

Test specification (reading):
Current while test button 1 pressed (no earlier than 2 minutes after starting):
15 ... 23 mA

Reading within test-specification tolerance?

No

Trouble-shooting:

No reading or reading incorrect:

Control unit defective.

Replace control unit.

Yes

Continued on next picture page

TEST STEP 22

Component/Function:
Control unit function
"actuator current with engine at normal op. temp."

Operation:	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	2

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 10 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Engine at normal op. temp.; run at idle speed.

Test specification (reading):
Current reading while test button 2 pressed:
-4 ... +7 mA.

Reading within test-specification tolerance?

No

Trouble-shooting:

Reading incorrect:

Control unit defective.

Replace control unit.

Yes

Continued on next picture page

TEST STEP 23

Component/Function:
Control unit function
"starting enrichment"

Operation:	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	1

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Operate starting motor. So that engine does not start, disconnect electric fuel pump energization relay and short-circuit ignition coil term. 4 to ground through min. 2 kΩ resistor.
Resistor: e.g. BOSCH sleeve-type suppressor (5 kΩ) 0 356 500 001 and spark gap 1 684 531 000.

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TEST STEP 23 (continued)

Test specification (reading):
While test button 1 pressed, operate starting motor. Current rises to:
68...88 mA.
Cut-back time: max. 1 second.

Reading within test-specification tolerance?

No

Trouble-shooting:

No reading or reading incorrect:

Control unit defective.

Replace control unit.

Yes

Continued on next picture page

TEST STEP 24

Component/Function:
Control unit function
"post-start enrichment"

Operation: / **Position:**

Operation	Position
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	1

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Operate starting motor.

Test specification (reading):
While pressing test button 1, start engine (at normal operating temperature).
Current reading: 24 ... 32 mA

Reading remains for approx. 45 sec., then slow cut-back to:
15 ... 23 mA

Readings within test-specification tolerance?

No

Trouble-shooting:

No reading or reading incorrect:

Control unit defective.

Replace control unit.

Yes

Continued on next picture page

TEST STEP 25

Component/Function:
Control unit function
"acceleration enrichment"

Operation:

	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	1

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Run engine at normal operating temperature and at idle speed.

Test specification (reading):
While pressing test button 1, accelerate engine suddenly. Current rises to: max. 66 mA.
Cut-back time: max. 1 second.
Note: Reading is dependent on the intensity of acceleration (distance/time of sensor plate movement).
Test specification and function O.K.?

No →

Trouble-shooting:

No reading or reading incorrect.

Control unit defective.

Replace control unit.

↓ Yes

Continued on next picture page

TEST STEP 26

Component/Function:
Control unit function
"overrun cutoff"

Operation:

	Position:
Progr. switch "V"	-
Progr. switch "Ω"	-
Test button	-

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter. If multimeter without automatic polarity changeover, swap over terminals (positive and negative).

Measuring range:
0 ... 100 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Run engine at normal operating temperature and at idle speed.

Test specification (reading), function:
Hold engine speed at approx. 2000 min^{-1}
Operate "idle" microswitch (on linkage) by hand. Engine hunts. Current reading during falling engine-speed phase: -40...-80 mA. Overrun cutoff must be suppressed with cruise control on.

Function and test specification O.K.?

No →

Trouble-shooting:

No reading or reading incorrect.

Control unit defective.

Replace control unit.

↓ Yes

Continued on next picture page

TEST STEP 27

Component/Function:
Control unit function
"full-load enrichment"

Operation:
Progr. switch "V"

Progr. switch "Ω"

Test button

Position:

-
-
-

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter

Measuring range:
0 ... 10 mA

Connection on adapter:
Black sockets 1 (-), 2 (+)

Operation in vehicle:
Run engine at normal operating temperature and at idle speed.

Test specification (reading), function:
Current reading at idle speed: -4 ... +7 mA.
Briefly fully depress accelerator ("full-load" throttle-valve switch must switch). Current reading must rise by: 3...8 mA.
Caution: Perform operation very briefly so that engine speed does not rise too much and so that engine damage is prevented.

Function and test specification O.K.?

No →

Trouble-shooting:

No reading or reading incorrect:

Control unit defective.

Replace control unit.

Yes ↓

Continued on next picture page

TEST STEP 28

Component/Function:
Closed-loop idle-speed control

Operation:
See "test procedure"

Test condition:
Control unit connected.

Measuring equipment:
Motortester or multimeter for voltage measurement.

Tachometer, e.g. motortester or commercially available.

CO analyzer, e.g. BOSCH ETT 008.04, ETT 008.05.

Measuring range:
Voltage measurement: 0 ... 10 V
0 ... 1 V
Tachometer and CO analyzer:
depending on version of equipment.

Connection on adapter:
Voltmeter:
Red socket (+)
Black socket (-)
Connect tachometer and CO analyzer in accordance with operating instructions.

Operation in vehicle:
See "test procedure".

Yes

Continued on next picture page

TEST STEP 28 (continued)

Test procedure, test specifications:
Run engine at normal operating temperature and at idle speed.
Idle speed:
650...690 min^{-1}

Raise engine speed several times and check whether the measured idle speed is re-established.

Measure CO concentration in exhaust.
Specification: 0.5...1.5 Vol.%

No →

Trouble-shooting:
If idle behavior not identical or unstable:

Idle actuator defective.

Replace idle actuator.

Adjusting the CO concentration
(Idle-mixture-adjusting screw in mixture-control unit):

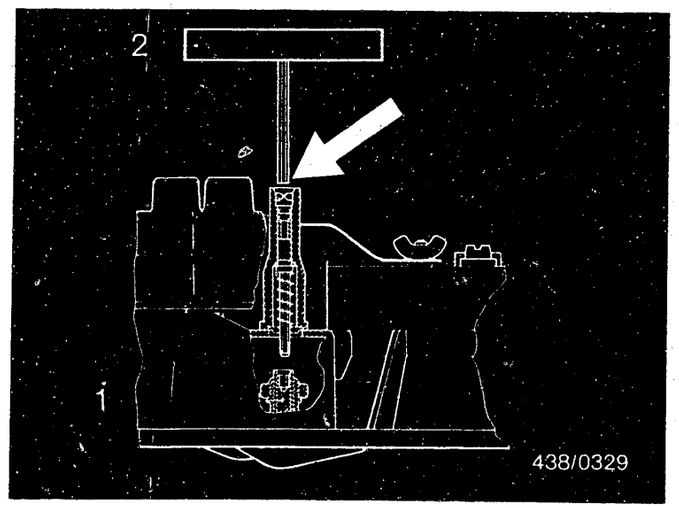
Adjust with air filter in place. Introduce adjusting wrench KDEP 1035 (2) through the special opening in the air filter (bottom diagram - arrow). Adjust idle-mixture-adjusting screw (1) by means of the setting device with spring loaded pin wrench which is rigidly mounted on the mixture-control unit. To do this, carefully press down pin wrench with adjusting wrench until pin wrench engages the idle-mixture-adjusting screw.

Turning in a clockwise direction = enriches mixture
Turning in a counter-clockwise direction = leans mixture

Remove adjusting wrench after adjusting. Unmetered air is prevented through automatic sealing.

Arrow = Idle actuator

1 = Idle-mixture-adjusting screw
2 = Adjusting wrench KDEP 1035



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TEST STEP 28 (continued)

Test procedure, test specifications:
(continued)

Measure air-flow sensor potentiometer supply voltage (engine idling):
Program switch "V":
Position 10
Voltmeter measuring range:
0...10 V
Specification (from test step 15):
4.35...5.35 V.
Note down precise reading.

Measure voltage signal from air-flow sensor potentiometer with engine idling:
Program switch "V":
Position 11
Voltmeter measuring range:
0...1 V
Find out from graph what specification should be according to measured supply voltage (bottom graph).

Reading within test-specification tolerance in graph?

No

Adjusting the voltage signal:
Note: The four fastening screws on the potentiometer must not be loosened. Adjustment must take place only at the small trimming potentiometer (to right of terminal strip).

To adjust, remove black sealing compound from trimming potentiometer (top diagram - arrow). Adjust voltage signal at idle speed according to supply voltage in graph (go for middle tolerance value). Adjust carefully using very small screwdriver.
Then lock trimming potentiometer adjusting screw with black sealing compound (e.g. Terroson).

If it is not possible to set the specified voltage signal by means of the trimming potentiometer, replace the entire air-flow sensor.

Yes

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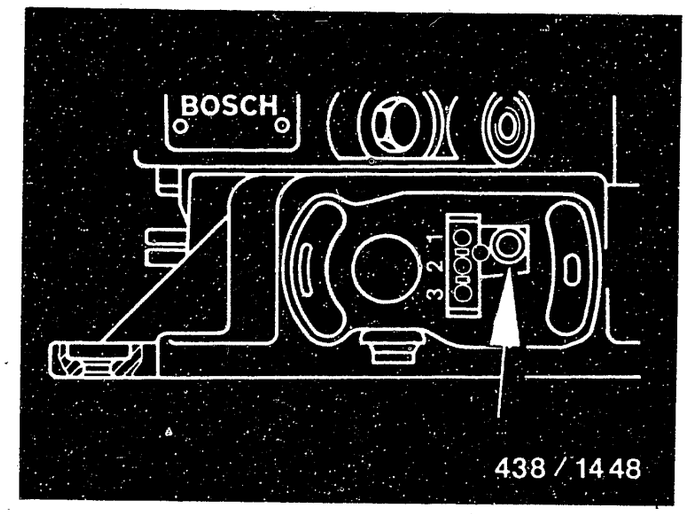
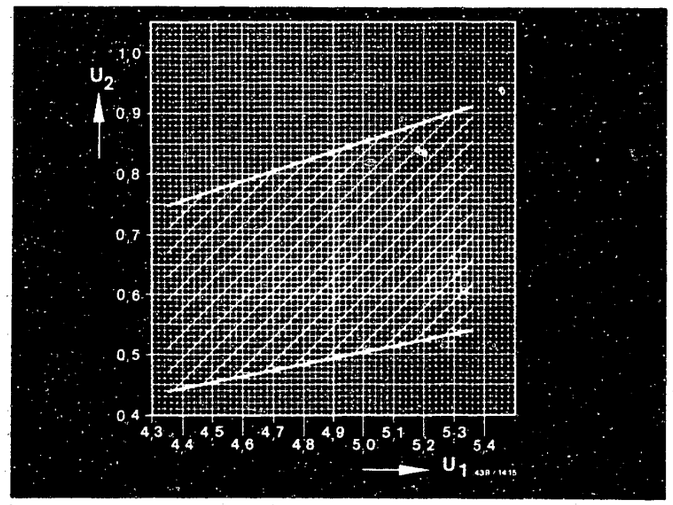


Arrow = Trimming potentiometer on air-flow sensor

U_1 = Potentiometer supply voltage
U_2 = Potentiometer voltage signal



TEST STEP 28 (continued)

Yes

Removing and installing the air-flow sensor:

Clean all fuel connections on fuel distributor and unscrew. Unscrew short lines also on the opposite side in order to prevent bending. Disconnect electrical plugs.

Remove complete mixture-control unit from the bracket. Unscrew fuel distributor and mount with new seal ring on the new air-flow sensor. Tightening torque for the three screws: 3.2...3.8 Nm.

Mount mixture-control unit with new gasket between bracket and air-flow sensor (Daimler-Benz service part) (do not use sealing compound). Tightening torque for air-flow sensor fastening screws: 9...10 Nm.

Connect all fuel lines and electrical plug.

Start vehicle and warm up. Check operation of potentiometer again. If necessary, adjust trimming potentiometer.

Continued on next picture page

TEST STEP 28 (continued)

Test procedure, test specifications:
(continued)

Brake vehicle at idle speed and select drive mode (with automatic transmission).
Idle speed: 500...600 min^{-1}
Switch off drive mode.
Switch on air conditioner (air conditioner switch, fan, temperature controller at min. temperature).
Idle speed: 600...700 min^{-1}

No

Trouble-shooting:

No reaction or readings incorrect:

Control unit defective.

Replace control unit.

End of test chart for universal test adapter.

19. IDLE ADJUSTMENT

19.1 General information:

The mixture is adjusted as usual by means of the idle-mixture-adjusting screw in the mixture-control unit.
The idle speed is adjusted automatically by the closed-loop idle-speed control. Conventional adjusting of the idle speed with the bypass screw is therefore not applicable. On the other hand, it is necessary to check whether the closed-loop control system is operating at the specified working point of its preselected working range. For this purpose, it is necessary to measure the signal of the air-flow sensor potentiometer and, if necessary, to adjust it, i.e. testing with universal test adapter and voltmeter connected.

19.2 Connecting the universal test adapter:

Slide KE control unit (top picture - arrow) upward in its mounting and remove.

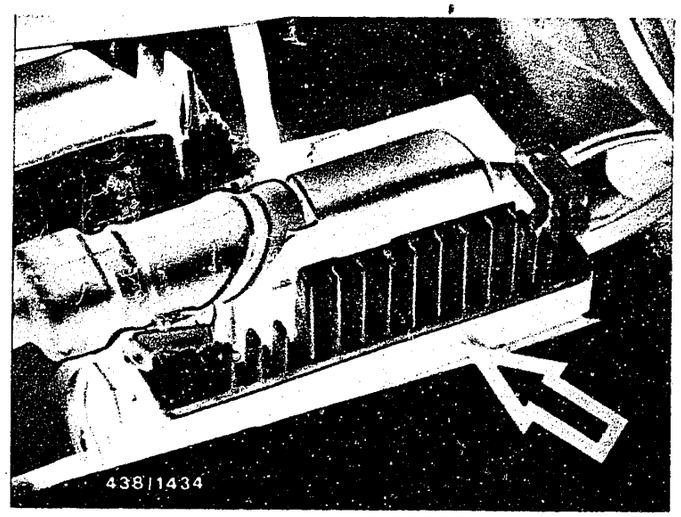
Disconnect control unit plug from control unit (push back detent and first of all hinge up plug on detent side). Connect plug to terminal strip of universal test adapter test lead. Connect multiple plug of test lead to control unit.

Important: Make sure that the ignition is off whenever connecting or disconnecting the control unit.

Connect multimeter at "V" test sockets for voltage measurement on universal test adapter. Suggested multimeter: e.g. BOSCH motortester MOT 300/400 or commercially available, e.g. Fluke-Multimeter 75.

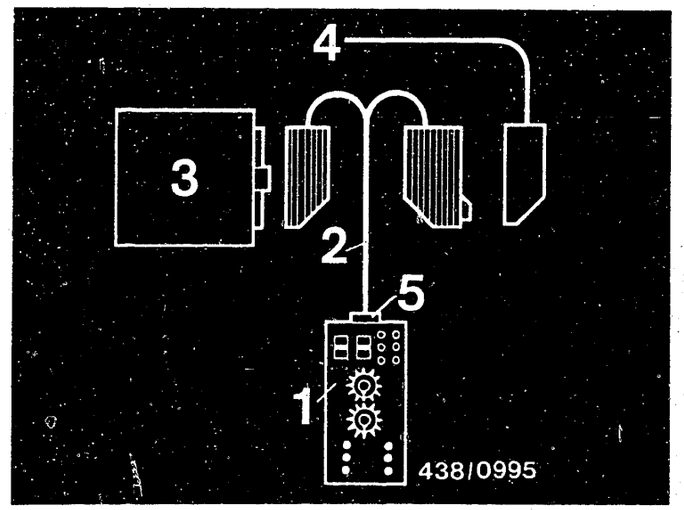
19.3 Further test equipment to be connected:

Tachometer, e.g. BOSCH motortester or commercially available.
CO analyzer: e.g. BOSCH ETT 008.04, ETT 008.05.



Arrow = KE control unit

1 = Universal test adapter
2 = System adapter lead
3 = Control unit
4 = System wiring harness
5 = Round-pin plug



19.4 Test procedure

TEST STEP 1

Run engine at normal operating temperature and at idle speed.
Idle speed:

650...690 min^{-1}

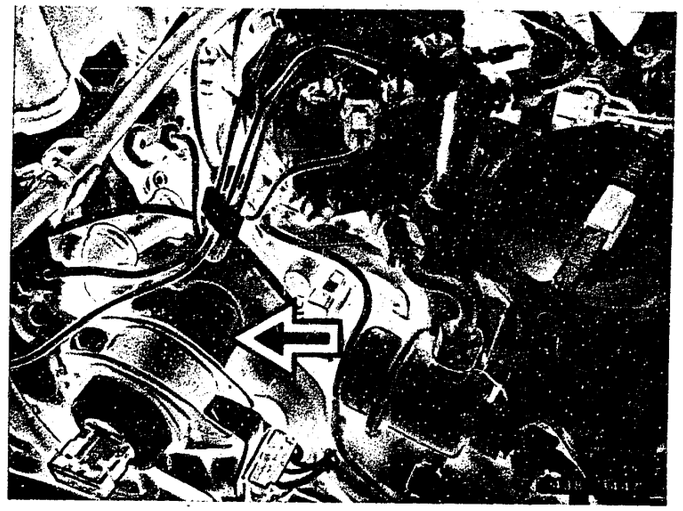
Raise engine speed several times and check whether the measured idle speed is reestablished.

No → **Trouble-shooting:**

If idle behavior not identical or unstable:

Idle actuator defective.

Replace idle actuator.



Arrow = Idle actuator

Yes

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TEST STEP 2

Measure CO concentration in exhaust.
Specification: 0.5...1.5 vol%

No

Adjusting the CO concentration (Idle-mixture-adjusting screw in mixture-control unit).

Adjust with air filter in place.
Introduce adjusting wrench KDEP 1035 (2) through the special opening in the air filter (top diagram - arrow). Adjust idle-mixture-adjusting screw (1) by means of the setting device with spring-loaded pin wrench which is rigidly mounted on the mixture-control unit. To do this, carefully press down pin wrench with adjusting wrench until pin wrench engages the idle-mixture-adjusting screw.

Turning in a clockwise direction = enriches mixture
Turning in a counterclockwise direction = leans mixture

Remove adjusting wrench after adjusting.
Unmetered air is prevented through automatic sealing.

Yes

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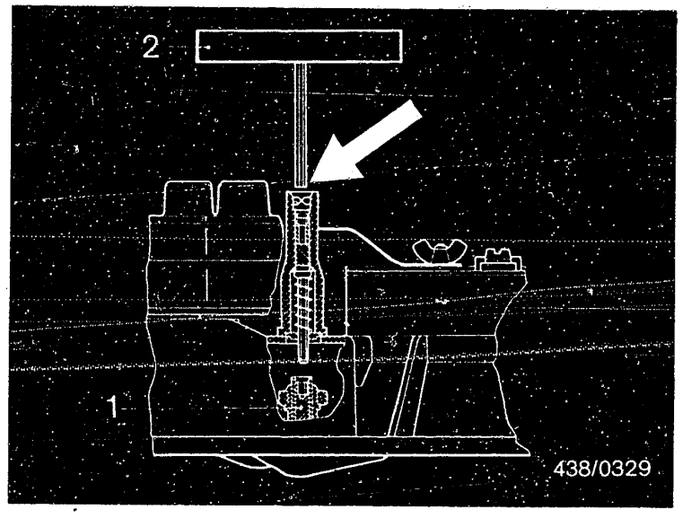

1 = Idle-mixture-adjusting screw
2 = Adjusting wrench KDEP 1035

TEST STEP 3

Measure air-flow sensor potentiometer supply voltage (engine idling):
Program switch "V":
Position 10
Voltmeter measuring range:
0...10 V

Specification: 4.35...5.35 V

Note down precise reading.

Measure voltage signal from air-flow sensor potentiometer with engine idling:
Program switch "V":
Position 11
Voltmeter measuring range:
0...1 V
Find out from graph what specification should be according to measured supply voltage (bottom graph).

Reading within test-specification tolerance in graph?

No →

Adjusting the voltage signal:
Note: The four fastening screws on the potentiometer must not be loosened. Adjustment must take place only at the small trimming potentiometer (to right of terminal strip).

To adjust, remove black sealing compound from trimming potentiometer (top diagram - arrow). Adjust voltage signal at idle speed according to supply voltage in graph (go for middle tolerance value). Adjust carefully using very small screwdriver.
Then lock trimming potentiometer adjusting screw with black sealing compound (e.g. Terroson).

If it is not possible to set the specified voltage signal by means of the trimming potentiometer, replace the entire air-flow sensor.

Yes ↓

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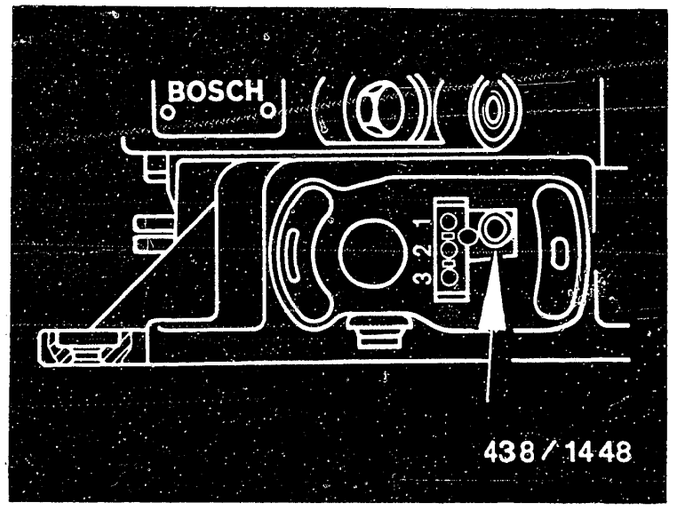
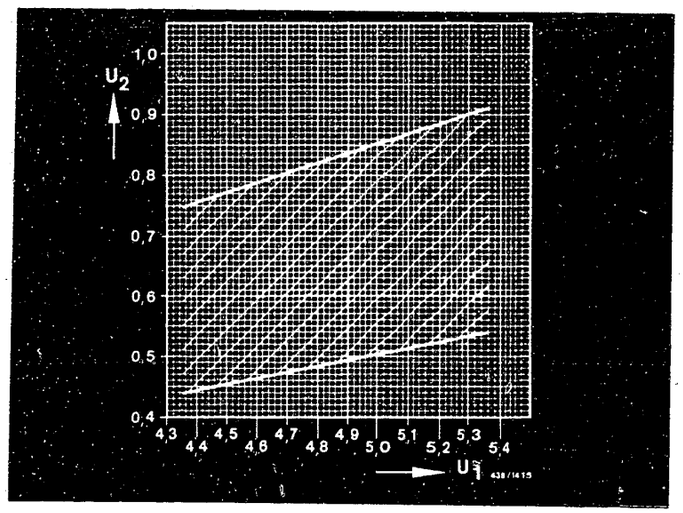


Arrow = Trimming potentiometer on air-flow sensor

U_1 = Potentiometer supply voltage
U_2 = Potentiometer voltage signal



TEST STEP 3 (continued)

Removing and installing the air-flow sensor:

Clean all fuel connections on fuel distributor and unscrew. Unscrew short lines also on the opposite side in order to prevent bending. Disconnect electrical plugs.

Remove complete mixture-control unit from the bracket. Unscrew fuel distributor and mount with new seal ring on the new air-flow sensor. Tightening torque for the three screws: 3.2...3.8 Nm.

Mount mixture-control unit with new gasket between bracket and air-flow sensor (Daimler-Benz service part) (do not use sealing compound). Tightening torque for air-flow sensor fastening screws: 9...10 Nm.

Connect all fuel lines and electrical plug.

Start vehicle and warm up. Check operation of potentiometer again. If necessary, adjust trimming potentiometer.

Continued on next picture page

TEST STEP 4

Brake vehicle at idle speed and select drive mode (with automatic transmission).

Idle speed: 500...600 min^{-1}
Switch off drive mode.
Switch on air conditioner (air conditioner switch, fan, temperature controller at min. temperature).

Idle speed: 600...700 min^{-1}

No

Trouble-shooting:

No reaction or reading incorrect:

Control unit defective.

Replace control unit.

End of idle adjustment

Anti-tamper device for idle-mixture-adjusting screw:

In the Federal Republic of Germany, Paragraph 47 of the FMWSS/CUR, "Exhaust Gases and their Discharge", has been amended. This amendment order was printed in full in the Verkehrsblatt 13 of 15th July 1975.

Accordingly, all motor vehicles with externally supplied ignition produced as of 1 October 1976 must be provided with anti-tamper devices for the idle-mixture-adjusting screw so that it is not possible to adjust the screw without destroying the anti-tamper device. The intention is to prevent non-experts from re-adjusting the idle setting and thus inadmissibly influencing the exhaust gas. Consequently, the anti-tamper caps may only be used in the workshop and must not be sold to customers for their own use. These anti-tamper caps come in different colors.

Use the following cap and color for after-sales service:
In the downdraft air-flow sensor:
Blue safety cap (not available from Bosch)
Mercedes-Benz part no. 000.997.5686
From Deutsche Vergaser Gesellschaft: K 34 520

The anti-tamper device for the air-flow sensor is removed and fitted using special tools (e.g. No. 4521/7 from the firm Hazet, D-5630 Remscheid).

After-sales Service

Technical Bulletin

Continuous Injection System mixture control-unit

VDT-I-438/100 B

Ed. 2 7.1975
Translation of German edition of 1.7.1975

The mixture control unit is still being reported as one defective unit in warranty claims. We wish to point out expressly that the mixture control unit consists of two separate products, the air-flow sensor and the fuel distributor, and that there are separate defect numbers for them in the warranty manual. Please report only the defective product.

Accessory Sets

Various fuel distributors and warm-up regulators have been supplied up to now with pressed-in plug connectors. These will no longer be supplied in future.

	no longer available	Replacement + accessory set
Fuel distributor	0 438 100 002	0 438 100 017
	0 438 100 003	0 438 100 005 + 2 437 001 001
	0 438 100 004	0 438 100 017
Warm-up regulator	0 438 140 002	0 438 140 004 + 1 437 000 000

The accessory sets contain the required number of tailpieces and seal rings.

Please note: the accessory set 2 437 001 000 is delivered included with the fuel distributor 0 438 100 017, and does not therefore need to be ordered separately.

Electric Fuel Pump

In the Technische Mitteilung VDT-BMO 114/1 B and the Service Information sheet VDT-I-740/2-1 B 1st. supplement, we announced that the non-return-valve can be replaced on the electric fuel pump 0 580 254 996. We have come to the conclusion from the warranty claims that not enough use is being made of this possibility. Please bear this fact in mind and repair leaky electric fuel pumps before deciding to replace the entire assembly.

In case of inquiry, please contact your authorized representative.

ROBERT BOSCH GMBH
Geschäftsbereich KH
Kundendienst - Technik

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.

After-sales Service

Technical Bulletin

Packaging of goods under warranty

438

K-Jetronic (CIS)

VDT-I-438/101 B
10. 1976

All components or assemblies of the K-Jetronic which are dispatched under warranty must be correctly and carefully packaged so that no further damage or impairments occur during transit, since these would not be covered by warranty.

Any fuel remnants must be removed from those K-Jetronic assemblies intended for dispatch, so as to eliminate any danger of fire during transit.

The intake openings and outlets of the assemblies must be sealed off with caps or plugs. As new products were fitted, the caps or plugs from these may be used.

The plunger of the fuel distributor is to be fitted with a protective cap of adequate size, or secured to the fuel distributor.

In addition, the assemblies are packed in tightly packed, well-sealed plastic sleeves. Fuel distributors and warm-up regulators are packed individually.

If components arrive damaged due to incorrect packaging or do not comply with these instructions, they can be returned and the warranty claim rejected.

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.

After-sales Service

Technical Bulletin

Securing of idle-speed adjusting screws

K-Jetronic (CIS)

438

VDT-I-438/102 B
11.1976

According to a statutory regulation, changes have been made to § 47 of the German traffic licensing laws concerning exhaust gases and their outlets. This regulation was printed in full in traffic law sheet 13 of 15.7.75 .

Consequently, all motor vehicles with external-ignition engines must have their idle-speed adjusting devices secured from the 1st October 1976, so that adjustment of the screw is impossible without destroying the securing device. This should stop unskilled people from adjusting the installation of the idle-speed system and thereby illegally influencing the emission values. As from now, securing caps can only be used in the workshop and cannot be sold to customers for their own use.

Securing caps are produced in various colors. For after-sales service the following caps and colors are used:

downdraft air-flow sensor	
Blue	securing cap is not available from BOSCH. Part number is DB 000.997.59 86 from the Deutsche Vergaser Gesellschaft K 34 520
updraft air-flow sensor	
Red	Part number 3 430 522 002

These stipulations are only valid in countries where ECE regulations (Economic Commission for Europe) apply. The air-flow sensors must however be converted for the use of these securing caps, as a matter of principle. The caps can also be used in countries not subject to ECE regulations, to prevent dirt penetrating through the pipe to the adjustment in the case of updraft air-flow sensors.

BOSCH Geschäftsbereich KH, Kundendienst, Kfz-Ausrüstung.

Technical Bulletin

EXCHANGEABLE NON-RETURN VALVES
in electric fuel pumps 0 580 254

VDT-I-438/104 En
3.1984
(Replaces Ed. 3.1983)

Electric fuel pump	Parts set (non-return valve + seal ring)	Non-return valve	Seal
0 580 254 001	1 587 010 500	---	---
003	502	---	---
005	502	---	---
007	500	---	---
008	508	---	---
010	508	---	---
011	002	---	---
941	002	---	---
942	002	---	---
945	006	---	---
947	002	---	---
948	005	---	---
949	002	---	---
950	006	---	---
952	002	---	---
953	501	---	---
954	002	---	---
956	002	---	---
957	002	---	---
959	002	---	---
960	002	---	---
961	002	---	---
963	005	---	---
964	002	---	---
965	002	---	---
967	002	---	---
968	002	---	---
970	002	---	---
972	002	---	---

Electric fuel pump	Parts set (non-ret. valve and seal ring)	Non-return valve	Seal
0 580 254 973	1 587 010 002		
975	003[4]		
976	004[3]		
978	1 587 410 901		
979	010 004[3]		
980	002		
982[1]	003[4]		
982[2]	1 587 410 901		
984	010 004[3]		
985	---	1 583 385 006	1 580 203 002
986	---	386 011	001
987	---	008	001
988	---	008	001
989	---	008	001
990	---	385 004	002
991	---	004	002
992	1 587 010 001	---	---
996		386 001	001
998		385 004	002
9 580 233 014	508	---	---
234 003	002	---	---
005	002	---	---

[1] = up to FD 822 [2] = as from FD 823

[3] = parts set ..003 can also be used (delivery-line connection at 90°)

[4] = parts set ..004 can also be used (delivery-line connection axial)

Please direct questions and comments concerning the contents to our authorized representative in your country.

After-sales Service

Technical Bulletin

438

VDT-I-438/109 En

8.1984

Replaces Ed. 4.1983

KE-JETRONIC

After-sales service procedure

Brief description of the system

The KE-Jetronic is a continuously operating gasoline injection system which is electronically controlled.

The difference from K-Jetronic: the warm-up control and additional control functions (e.g. starting enrichment and overrun fuel-cutoff) are taken over by an electro-hydraulic pressure-correcting element which replaces the warm-up regulator. The pressure-correcting element is fitted directly onto the fuel distributor.

Users

Mercedes-Benz as the first vehicle manufacturer to offer KE-Jetronic, has fitted it to the 190 E (type W 201, starting 10.1982).

Components

Air-flow sensor		0 438 121 001
Fuel distributor		0 438 101 001
Pressure-correcting element (parts set)		3 437 010 027
Auxiliary-air device		0 280 140 161
Injection valves		0 437 502 010
Electric fuel pump		0 580 254 950
Fuel filter		0 450 905 406
Fuel accumulator		0 438 170 038
Start valve		0 280 170 412
Pressure regulator		0 438 161 001
Temperature sensor		0 280 130 031
Control unit		0 280 800 100
	as of 12.83	0 280 800 110

The part numbers are also listed on the vehicle equipment microfiche AA.. .

Service/exchange parts

The air-flow sensor can be partly repaired (for scope of replacement see microfiche EE .. under 0 438 121 ..). The fuel distributor and the control unit are also available as exchange items (see exchange microfiche WB .. and exchange price list PD 02).

Testing concept

The testing of the system in the vehicle is carried out not only with the test apparatus used for K-Jetronic, but also with the universal test adapter in conjunction with a special system adapter cable as well as a commercially available multimeter.

Universal test adapter
ETT 018.01 part no. 0 684 101 801
System cable part no. 1 684 463 135

Supplied through normal channels (BG, RG/AV).

Technical documentation

Technical bulletin "New Product" VDT-I-438/3 En.
Trouble-shooting instructions and test specifications: SIS microfiche MB 501.

Training

Technical training for this system is integrated into the courses on K-Jetronic and Jetronic special.

Retrofitting

This system is not intended for retrofitting.

Guarantee procedure outside of Germany

Components on which a claim is to be made should be sent for inspection during the guarantee period to the national representative in your country.

Published by:

Robert Bosch GmbH
Division KH
Technical After-Sales Service (KH/VKD 2)

Please direct questions and comments concerning the contents to our authorized representative in your country.

After-sales Service

Motor Vehicle Service Information

LIQUID PETROLEUM GAS (AUTOGAS) SYSTEMS AND VEHICLES WITH K-JETRONIC

VDT-I-Gen. 052 En
10.1982

Fitting at a later stage

Vehicles with K or L-Jetronic are not suitable for fitting at a later stage with liquid petroleum gas (LPG) systems.

Numerous problems can occur, such as:

- Reduction of fuel flow through the injection valves due to deposits
- Stiffness or blocking of the K-Jetronic fuel distributor plunger (due to gumming or similar) in the course of time with "gas only operation."
- Increased danger of backfiring in the intake manifold (burbling) and thereby damage to the air-flow sensor.

Guarantee

Guarantee claims for failed Jetronic components from vehicles thus converted will not be accepted.

Conversion to liquid gas operation is made at the risk of the vehicle owner.

BOSCH Geschäftsbereich KH. Kundendienst. Kfz-Ausrüstung.

After-sales Service

Motor Vehicle Service Information

UNIVERSAL TEST ADAPTER

VDT-I-Gen. 1001 En
1.1982

1. Application

The multiplicity of different fuel-injection and ignition systems at present available on the market, as well as the advances in development which can be expected in the future, demand a new testing concept. In order to maintain the outlay for test equipment, and hence the costs, at a reasonable limit we have developed the universal test adapter.

The following systems can be tested using a test-adapter universal unit together with adapter leads suited to the system in question:

1.1 Systems which are already being fitted as series:

- L-Jetronic (1st generation)
- LE-Jetronic (2nd-generation L-Jetronic)
- Motronic (with the new connector designation, refer to the vehicle-specific instructions!)

1.2 Systems whose introduction is planned:

- Motronic with gearbox control
- KE-Jetronic
- Mono-Jetronic
- Electronic ignition system with ignition map (EZF)

2. Delivery dates and Part Numbers

Available as from 2.1982.

2.1 Universal test adapter (basic unit)

Part Number: 0 684 101 801

Designation: ETT 018.01

2.2 System adapter lead for LE-Jetronic (2nd-generation L-Jetronic)

Part Number 1 684 463 123

First application: For BMW 2.5/2.8 l engines as from 9.1981, and for Opel 2.0 l engines (Manta/Rekord) as from 9.1981.

BOSCH
Geschäftsbereich KH. Kundendienst, Kfz-Ausrüstung.

2.3 System adapter lead for Motronic with new connector assignment.

(Refer to the vehicle-related instructions!)

Part Number : 1 684 463 124
First application: Porsche 944 as from series production, BMW as from about 3.1982 (Europe)

2.4 System adapter lead for L-Jetronic (in preparation)

Further system adapter leads will be made available along with the introduction of the new systems as mentioned above.

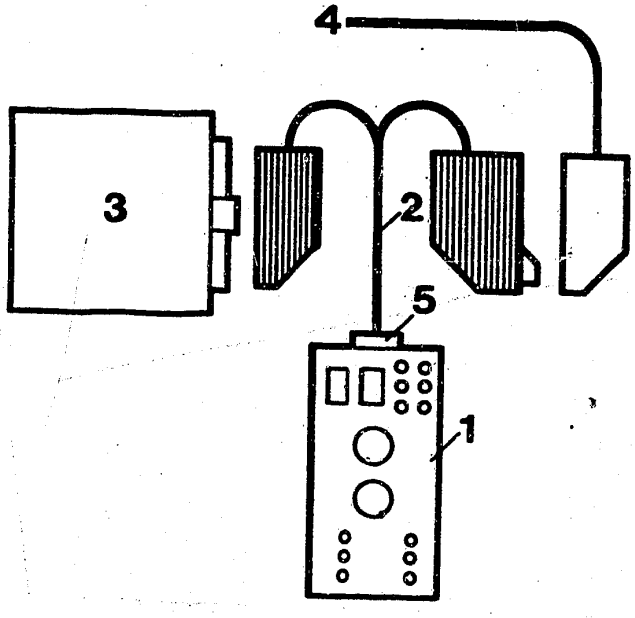
3. Testing procedure

The systems and the components are tested for voltage and resistance values as well as for correct functioning. Evaluation is by means of a multimeter and the Motortester which are connected into the universal test adapter.

Depending upon the complexity of the system, interchangeable adapter lead model 1 or model 2 is provided:

3.1 Adapter lead for peripheral and function testing (Model 1)

The universal test adapter together with the system adapter lead is to be connected to the system wiring harness and to the control unit (e.g. Motronic).
To be tested: Wiring harness with components and control unit.

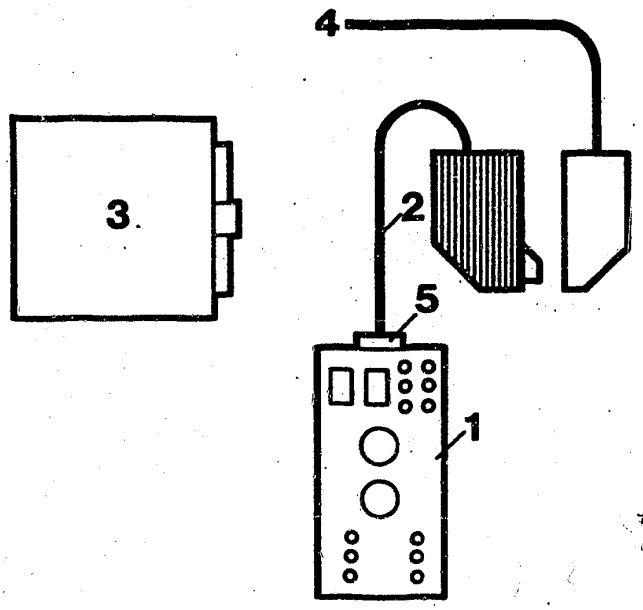


1 = Universal test adapter (basic unit)
2 = System adapter lead (Y-version)
3 = Control unit
4 = System wiring harness
5 = Plug connection

3.2 Adapter lead for peripheral testing (Model 2)

The universal test adapter with system adapter lead, is only to be connected to the system wiring harness (e.g. LE-Jetronic (2nd-generation L-Jetronic)).

To be tested: Wiring harness with components (without control unit).

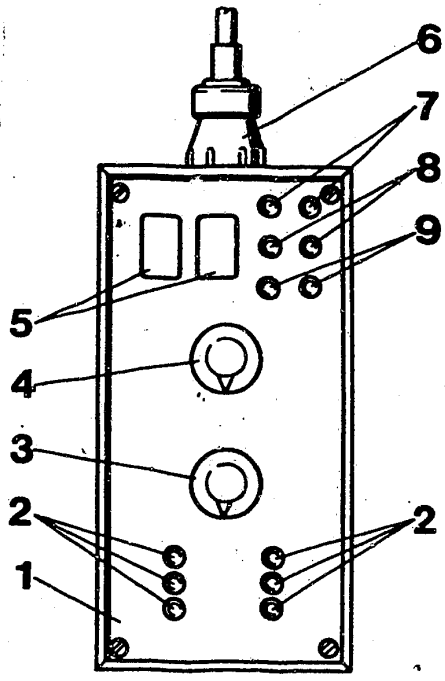


1 = Universal test adapter (basic unit)
2 = System adapter lead
3 = Control unit (not connected)
4 = System wiring harness
5 = Plug connection

4. Construction of the universal test adapters

The universal test adapter is fitted with 2 program switches footage and resistance measurement. The measured values are displayed on the multimeter connected to the universal test adapter. For reasons of safety, the voltage and resistance sockets are separated. In order to measure signals (e.g. injection pulses, ignition pulses), it is necessary to connect a Motortester to the measuring cavities (special input).

When carrying out functional tests with the control unit connected, selected push-buttons are pressed in a number of test-program steps in order to simulate a variety of different engine operating conditions the influence of which is evaluated using the Motortester.



1 = Universal test adapter (basic unit)

2 = Keyboard for simulation of various conditions e.g. engine temperature, throttle position etc.

3 = Program switch "Ohm" for resistance measurement

4 = Program switch "Volt" for voltage measurement

5 = Measurement "cavities" (for the special input from the Motortester)

6 = 63-pole plug-in connection for connecting the system adapter lead

7 = Measurement sockets (voltage measurement with a multimeter or with the Motortester)

8 = Measurement sockets (resistance measurement with the multimeter)

9 = Sockets for special functions (not yet allocated)

Notes:

1. The Motronic test adapter (0 684 101 800, ETT 018.00) will continue to be used for Motronic-equipped BMW vehicles (with old connector assignment) up to about year of manufacture 3.1982 (refer to vehicle-specific instructions).

2. Details on the operation of the universal test adapter, and the test specs, are to be found in the vehicle-specific after-sales service instructions.

3. Caution! Change of Part Number:

On the SIS-microfiches OPE-00/J22 (Coordinates A14 and A17) the new Part Numbers are as follows:

Universal test adapter: 0 684 101 801

Adapter lead : 1 684 463 123

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